The Engineer.

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PUBLIC NOTICES

HEATING.

The Commissioners of His Majesty's Works, &c., are prepared to receive TENDERS before 11 a.m. on Wednesday, 21st January, 1931, for ACCELERATED LOW-PRESSURE HOT WATER HEATING, &c., at the Employment Exchange, &c., Darlington.

Drawings, specification, a copy of the conditions and form of contract, bills of quantities and forms for Tender may be obtained from the CONTRACTS BRANCH, H.M. Office of Works, King Charles-street, London, S.W. 1, on payment of One Guinea. (Cheques payable to the Commissioners, H.M. Office of Works.) The sums so paid will be returned to those persons who send in Tenders in conformity with the conditions. 6283

A Vacancy Exists at Royal Naval Torpedo Factory, Greenock, for a DESIGNER with good drawing-office experience, practical workshop experience and high technical ability.

The work involves the preparation of original design and detail of components of torpedoes and preference will be given to candidates with initiative and imagination whose records demonstrate their ability to depart from orthodox practice where necessary.

Applicants should NOT BE MORE THAN 35 YEARS OF AGE. Commencing salary £300, rising by annual increments of £15 to £350. Civil Service cost-of-living bonus also payable; this is subject to review every six months, and at present amounts to £114 on a salary of £300 and to £125 on a salary of £350.

Appointment will be terminable at three months' notice on either side, but good prospect of permanent employment for a really suitable man.

Applications should be addressed to the SECRETARY OF THE ADMIRALTY (C.E.), Whitehall, London, S.W. 1, and should be received not later than 15th January, 1931.

Candidates may subsequently be invited to attend for an interview in London, and the expense of such attendance will not be payable from public funds. 6272

Crystal Palace School of Practical Engineering.

Principal: MAURICE WILSON, M. Inst. C.E.
Vice-Principal: F. C. P. LAWRENCE, M.S.E., A.M.I. Struct. E.

EASTER TERM, 1931, COMMENCES ON WEDNESDAY, JANUARY 7th. 6297

CITY OF LONDON.

THE SIR JOHN CASS TECHNICAL INSTITUTE,

Jewry Street, Aldgate, E.C. 3.

Principal:

GEO. PATCHIN, A.R.S.M., M.I.M.M.

LAW AND INDUSTRY.

A course of Ten Lectures, Tuesday evenings, 7–8 p.m., commencing January 13th, 1931, by

G. S. W. MARLOW, B.Sc., F.I.C.
(*Barrister-at-Law, Gray's Inn*)

The lectures will deal with English Law as it affects industrial operations and meets the requirements of those holding, or wishing to qualify themselves to hold, responsible executive appointments, and no previous legal knowledge is assumed.

CHEMICAL PLANT.

A series of lectures by recognised experts, Thursday evenings, 7–8 p.m., Second part commencing January 15th, 1931.

METALLURGY FOR ENGINEERS.

Courses in Metallurgy, Assaying, etc., designed to meet the requirements of Engineers and those wishing to prepare for the degree of B.Sc. (Eng.) in Metallurgy of London University.

For further particulars apply to the PRINCIPAL.

University of London. The Senate invite APPLICATIONS for the UNIVERSITY CHAIR of ENGINEERING (Mechanical Engineering and Motive Power), tenable at the Imperial College—City and Guilds College. Salary not less than £1500 a year.—Applications (12 copies) must be received not later than first post on 16th February, 1931, by the ACADEMIC REGISTRAR, University of London, S.W. 7, from whom further particulars may be obtained. 6301

Bombay, Baroda and Central INDIA RAILWAY CO.

The Directors are prepared to receive up to Noon on Wednesday, 14th January, TENDERS for the SUPPLY of :—

COPPER RODS AND SHEETS.

Tenders must be made on forms, copies of which, with specification, can be obtained at these offices on payment of 10s. each (which will not be returned).

The Directors do not bind themselves to accept the lowest or any Tender.

S. G. S. YOUNG,
Secretary.

Offices: The White Mansion, 91, Petty France, Westminster, S.W. 1.
29th December, 1930. 6282

The Engineer

PRINCIPAL CONTENTS OF THIS ISSUE.

PROGRESS OF THE

ENGINEERING, SHIPBUILDING,

AERONAUTICAL

and

TRANSPORT INDUSTRIES

in 1930.

(With an Eight-page Supplement).

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PUBLIC NOTICES

County Borough of Sunderland.
DEEP-WATER QUAY.—CONTRACT NO. 1.
TO CONTRACTORS.

The Corporation of Sunderland are prepared to receive TENDERS for the SINKING of CONCRETE MONOLITHS, the CONSTRUCTION of a REINFORCED CONCRETE RETAINING WALL and other WORKS in connection with the Construction of a New Quay upon a site in and adjoining the River Wear at Sunderland, County Durham.

The contract documents may be seen upon application to the Engineer for the scheme, W. H. S. Tripp, M. Inst. C.E., c/o River Wear Commissioners, St. Thomas-street, Sunderland, before the 24th January, 1931, or may be obtained from him until that date on payment of a deposit of Ten Pounds by crossed cheque, which will be returned on receipt of a bona fide Tender accompanied by the whole of the documents issued.

Tenders, which will only be considered if made upon the form supplied, must be completed in accordance with the detailed instructions incorporated in the documents, enclosed in a sealed cover, endorsed "Tender for Deep-water Quay, Contract No. 1," and delivered at the office of the undersigned, Town Hall, Sunderland, not later than noon on the 26th January, 1931.

The Corporation do not bind themselves to accept the lowest or any Tender.

H. CRAVEN,
Town Clerk.

Town Hall, Sunderland.
22nd December, 1930. 6275

Stockport Corporation Water WORKS.
GOYT VALLEY SUPPLY.
TRUNK MAIN, 30in. DIAMETER; VALVES, PIPES, IRONWORK, &c.

TENDERS are INVITED for the SUPPLY of VALVES, PIPES, &c., required in connection with the first length to be laid of the above Trunk Main.

The drawings may be seen and specification, form of Tender and schedule obtained on application to Messrs. G. H. Hill and Sons (Manchester), 40, Kennedy-street, Manchester, upon receipt of a cheque for Two Guineas, which will be returned to the applicant provided that he shall have sent in a bona fide Tender and shall not have withdrawn the same and shall have returned the documents and drawings lent to him.

A limited number of copies of the drawing are available and will be lent to persons tendering in priority of application upon receipt of the sum of Half-a-Guinea, which sum will not be returned.

Sealed Tenders, endorsed "Goyt Valley Supply, Contract No. 2," and addressed to the "Chairman of the Waterworks Committee," must be delivered at the Waterworks Offices, Town Hall, Stockport, not later than January 17th, 1931.

The Committee do not bind themselves to accept the lowest or any Tender.

ROBERT HYDE,
Town Clerk.

Town Hall, Stockport.
December 24th, 1930. 6274

PUBLIC NOTICES

Smethwick Education Committee.

The Committee is prepared to receive SCHEMES and TENDERS for the LOW-PRESSURE HOT WATER HEATING of the Holly Lodge High School for Boys (accommodation 600); the heating medium may be either coke, oil, gas, or electricity.

Further details and the necessary plans can be obtained from the Director of Education, Education Offices, 215, High-street, Smethwick, by sending a deposit of £3 3s., which will be returned to all firms submitting a bona fide Scheme and Tender. All Schemes and Tenders must be received by the 31st January, 1931.

S. CHILDS,
Director of Education.

Education Offices,
215, High-street, Smethwick,
29th December, 1930. 6278

Great Southern Railways.
DRAUGHTSMAN.

The Directors of the Great Southern Railways REQUIRE the SERVICES of a JUNIOR DRAUGHTSMAN.

Applicants should not exceed 25 years of age, and should have experience in Civil Engineering. Commencing salary £150 per annum.

Applicants should state age and give full particulars of training and experience, and applications should be accompanied by not more than two copies of recent testimonials, and should be posted so as to reach the undersigned not later than 5 p.m. on Monday, the 26th January, 1931.

H. S. COE, Secretary.

Kingsbridge Station, Dublin, W. 6,
January, 1931. 6281

Government of Northern IRELAND.

CIVIL ENGINEERING APPOINTMENT.

The Ministry of Finance invites APPLICATIONS for the APPOINTMENT of TEMPORARY ASSISTANT CIVIL ENGINEER.

Candidates must hold a University Degree in Engineering, or, alternatively, have had practical training in Civil Engineering. Experience in the design and calculation of steel structures (both buildings and bridges) and in reinforced concrete is essential.

Applications, giving full particulars of qualifications, training and experience and stating the salary required, should be made on the prescribed official form, which can be obtained from the SECRETARY, Ministry of Finance (Establishment Division), 15, Donegall-square West, Belfast, and should be returned, duly completed, so as to reach him NOT LATER THAN THURSDAY, 15th JANUARY, 1931. 6277

SITUATIONS OPEN

COPIES OF TESTIMONIALS, NOT ORIGINALS, UNLESS SPECIFICALLY REQUESTED.

WANTED by Old-established Midland Firm, a young ENGINEER, to assist sales development of special Electrical Apparatus, especially among county and municipal authorities. Electrical knowledge an advantage; previous sales experience essential.
Address, 6286, The Engineer Office. 6286 A

WANTED, for India, CIVIL-ENGINEER SALESMAN for large Contracts; age about 25; single; Public School or University preferred. State full particulars and send photograph.—Address, 6295, The Engineer Office. 6295 A

WANTED, PRACTICAL ENGINEER, with General workshop experience, to assist in management of small old-established Engineering Works and Foundry in West of England, with view to partnership.
Must be keen and energetic and not over 30.
Address, P630, The Engineer Office. P630 A

ENGINEER REQD. as Tea Estate Assist., India. Age 22/23, single; 5 yrs. apprenticeship and sec. or pub. school educ. essen. Rs. 275 p. mth., with qtrs., servant, passage, &c.
Apply, LAURIE and CO., Employment Specialists, 28, Basinghall-st., London, E.C. 2. No preliminary fee. P626 A

ENGINEERING MECHANIC, for South Africa; Garage and General Engineering Work; qualified in Electrical Plant, Street and House Wiring. State qualifications, references.—Address, 6300, The Engineer Office. 6300 A

HEATING ENGINEER REQUIRED, with All-round experience and sound mechanical training.—Apply, stating experience, age, and salary required, to ASHWELL & NESBIT, Ltd., Engineers, Leicester. 6285 A

REPRESENTATIVES REQUIRED on Commission basis in all industrial centres of Gt. Britain, for the Sale of Keenok Patent Reduction and Increasing Gears. Engineering knowledge essential. State full particulars of experience and area covered.
KEENOK GEARS, Ltd., Oaklands-road, London, N.W. 2. 6293 A

SMART LIFT ELECTRICAL ENGINEER REQUIRED; must have first-class experience in a similar position and be familiar with A.C. and Variable Voltage Control. Good salary and prospects for right man.—Address, 6299, The Engineer Office. 6299 A

TWO TEMPORARY ASSISTANTS REQUIRED IMMEDIATELY for Large Main Drainage Scheme. Respective salaries £450 and £200 per annum.—Address, 6290, The Engineer Office. 6290 A

YOUNG ENGINEER REQD. for Sales Work, Fed. Malay States. Age 23/24, single. Univ. degree and pract. mech. exp. £420 p.a.—Apply, LAURIE and CO., Employment Specialists, 28, Basinghall-st., London, E.C. 2. No preliminary fee. P625 A

DRAUGHTSMEN, 2, First-class, Used to Lift Layouts and Measuring; permanent position.—Address, stating age, experience and salary required, 6296, The Engineer Office. 6296 A

SITUATIONS WANTED

ADVERTISER, with Large Active Connection among buyers of steel and iron bars, sections, plates, &c., in East Anglia, is OPEN for ENGAGEMENT, commission basis. Own car.—Address, 6288, The Engineer Office. 6288 B

CHARTERED SECRETARY, with Long Experience management commercial side Engineer Contracting Company, SEEKS APPOINTMENT. Would go abroad, preferably South America.—Address, P629, The Engineer Office. P629 B

COST and WAGES CLERK (Man, 28 Years), accust. to large pay rolls, prod. costs and supervision. Acc. and offic. methods.—Write, G., 67, Milton-road, Hanwell, W. 7. P623 B

ENGINEER, Age 28, First-class B.O.T. Cert., SEEKS responsible POSITION ashore. Experienced with all modern machinery. Highest testimonials.—Address, P632, The Engineer Office. P632 B

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WATER SOFTENING ENGINEER, 12 Years on technical staff with firm of world-wide repute. Specialist in rectification of defective heating installations, &c., SEEKS APPOINTMENT where abilities may have adequate scope.—Address, P634, The Engineer Office. P634 B

DRAUGHTSWOMAN, 15 Years' Exp. Drawing and tracing (mech. and elec.), REQUIRES EMPLOYMENT. Salary 70s. weekly.—Address, P631, The Engineer Office. P631 B

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FOR SALE

BOILERS, TANKS and AIR RECEIVERS.

New, several, 11ft. long by 5ft., Reca., 80 lb. W.P.
Lancashire Boiler, 30ft. by 7ft., 80 lb. W.P.
Cornish Boiler (1915), 24ft. by 6ft. 6in., 80 lb. W.P.
TANKS (Boiler Shells), 30ft. by 8ft., extra heavy.
Ditto 30ft. by 7ft.

H. & T. DANKS (Netherton), LTD.,
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5840 o

FOR SALE.—
ONE 12in. CENTRIFUGAL PUMP, by Drysdale, coupled direct to Four-cylinder PETROL ENGINE, complete with Suction Pipes and Connections.
30in. METAL BAND SAWING MACHINE, by Clifton and Waddell.
ONE SET of 6in. by 12in. Belt-driven HORIZONTAL QUADRUPLE-ACTING PUMPS, capacity 12,000 gallons per hour to a total head of 200ft.
10in. by 7in. by 10in. Worthington DUPLEX STEAM PUMP.
6in. by 6in. by 6in. VERTICAL DUPLEX STEAM PUMP, by Dawson and Downey.
List of Second-hand Machinery sent on application.
STANLEY ENGINEERING COMPANY, Bath. Telephone, Bath 4294 (2 lines).

For continuation of For Sale Advertisements see page 92.

Spencer-Bonecourt Patent Waste Heat Boilers.
Broadway Bldgs., Broadway, Westminster, S.W.1.

"NICLAUSSE"
—10,000,000 H.P. in service—
WATER TUBE BOILERS.
SUPERHEATERS—ECONOMIZERS
Automatic Stokers.
THE BRITISH NICLAUSSE BOILER CO., LTD.
The Clock House, Arundel St., Strand, W.C.

GRIT CATCHING.

Pneumatic Conveyance & Extraction (1929), Ltd.

have pleasure in announcing that

The Calcutta Electric Supply Corporation Ltd.

have decided to instal

A Further 'F' Type 'Pneuconex' Grit Catcher

totalling

Four Equipments

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AS SUPPLIED TO
THE ADMIRALTY, WAR OFFICE, AND OTHER GOVERNMENT DEPARTMENTS.
ATLANTIC ENGINE CO., WISHAW, SCOTLAND.
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600

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Included in our Northern Depot Stock of Machine Tools are the following two practically new items:—

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De Bergue 6ft. × 1in. Plate Guillotine Shearing Machine, with two spare sets of new blades; arranged for direct motor drive, but without electrical equipment; power required 35 h.p. D.C. or 47 h.p. A.C., to run at 600/720 R.P.M.

A full specification and price of the above will be gladly sent on request.

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GEORGE COHEN SONS & CO. LIMITED
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FOR ALL CLASSES OF
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'PHONE: HOP 1305. WIRE: KINNELL-BOROH, LONDON.

JANUARY 2, 1931.—VOL. CLI.

THE ENGINEER.

A Seven-Day Journal

The G.W.R. Programme for 1931.

THE directors of the Great Western Railway Company have authorised the undertaking of an extensive programme of new works during the year which has now begun. At Swindon 120 locomotives and 287 vehicles are to be built at a cost of £1,199,000. Of the engines, 80 are to be of the tank type, and of the vehicles 163 will be passenger coaches and 20 will be restaurant cars. A sum of £126,600 has been allocated for the provision of 219 new motor road vehicles and tractors. On the civil engineering side 400 miles of the permanent way are to be relaid and 100 miles are to be re-sleepered. This work will involve the laying of 37,000 tons of new rails, 700,000 sleepers, and 500,000 tons of ballast. In addition, 8000 tons of steel will be required in connection with the reconstruction of bridges and other structures. A sum of £40,000 is to be expended on the reconstruction of Carnon Viaduct on the Falmouth branch. When this work has been completed only two of Brunel's original wooden viaducts will remain to be replaced. In addition to these works, a total sum of over £540,000 is to be expended on numerous minor improvements. Apart from the undertakings covered in this year's programme, the company already has in hand development schemes aggregating £8,500,000 in capital expenditure. Of these schemes an important one is the extension and improvement of Paddington Station, on which £1,000,000 is being spent. Another one of much interest is the equipment of 2000 engines and practically all the company's main lines—1758 miles of track to be exact—with automatic train control. The works at Paddington Station are to be completed by 1933. In the main they are concerned with the reconstruction and enlargement of that portion of the terminus which is known as Bishop's-road Station and the transference of all the suburban traffic from the main station to its reconstructed subsidiary.

The New Tees Bridge.

IT is announced that Dorman, Long and Co., Ltd., have been successful in obtaining the contract for the erection of the new Tees Bridge at Newport, Middlesbrough. Their contract price was the lowest of several tenders opened on Tuesday. The bridge is the joint project of the Durham County Council and the Middlesbrough Corporation, and is to be financed to the extent of 75 per cent. of the cost by the Government. Although the contract price has not been disclosed, it is understood to be in the neighbourhood of £450,000. The bridge will be of a type unusual in this country, in that it will have a central lifting span which will rise vertically to allow shipping to pass through. Dorman, Long and Co., Ltd., have now in hand contracts involving several million pounds sterling. They include the Sydney Bridge—the total cost of which will be over £8,000,000—the Scotswood Bridge over the Tyne, £32,000; the Lambeth Bridge, £500,000; the Putney Bridge, £433,000; the Rhyl Bridge, £86,000; the Kasr-el-Nil Bridge in Egypt, £292,000; the Memorial Bridge in Siam; three rolling bascule bridges at Liverpool; iron and steel works in Pretoria, £1,500,000; a bridge over the river Foyle, Ireland, £255,000; and several big steel constructional jobs in London.

The Canterbury and Whitstable Railway.

WITH the passing of 1930 the running of passenger trains on the Canterbury and Whitstable Railway came to an end. The Southern Railway Company's decision to confine the use of the line in future to the transport of goods conforms with the fact that for a number of years past travellers between Canterbury and Whitstable have shown an almost exclusive preference for effecting their journeyings by road. The historic little railway, with its heavy gradients and its celebrated tunnel beneath Tyler Hill, has never been profitable since it was opened over a hundred years ago. Proposals for the construction of the railway were made in, or about, the year 1825, definitely before the opening of the Stockton and Darlington Railway. George Stephenson was responsible for the general plan of the line, but not for its actual construction. It was estimated to cost £31,000, but by the time it was opened for traffic on May 3rd, 1830, £70,000 had been expended upon it. The "Invicta" ran on the line. She was Stephenson's No. 20. The "Rocket" was No. 19. The "Invicta" is now preserved on a pedestal in the Dane John Gardens at Canterbury. In 1843 the line was taken over by the South-Eastern Railway. Why this little 6-mile railway should have been among the first to be constructed in this country is, to-day, difficult to understand. Whitstable is certainly the nearest port to Canterbury, but the commerce of the Cathedral City is not, and, a hundred years ago, was not so great as to demand a route of its own to the coast. It is, and never has been anything else, than a local cross-country line. Many years after it was opened came the laying of the lines from London through Canterbury to Dover, and through Whitstable to Margate and Ramsgate. The Canterbury and Whitstable formed merely a connection between these two lines. It formed an essential part of neither. In that respect it differed from the Stockton and Darlington, and the Manchester and Liverpool, both of which were fortunate in fitting later on into much larger schemes of railway construction. One of the reasons for the building of the Canterbury and Whitstable line is said to have been the desire to provide a means of communication between London and Canterbury—by ship to Whitstable and thence by rail—that would avoid the use of the roads. There is food for philosophy in the reflection that it is the superior attractions of modern road transport which have driven the little railway out of its passenger-carrying business.

New Italian Cruisers.

SHORTLY before Christmas there was launched from the Ansaldo shipyards at Genoa the new Italian light cruiser "Bartolomeo Colleoni," the last of three ships which have been constructed for the Royal Italian Navy by the Ansaldo Company. The other two ships are the "Alberto Di Giussano" and the "Alberico Da Barbiano," which on their trials showed average speeds of over 39 knots. One of the ships, we understand, attained a maximum speed on trial of 40·7 knots. The displacement of the new cruiser is 5250 tons and the designed speed 27 knots, while the length is 554ft. and the beam 50ft. A twin-screw arrangement of geared turbines with a total designed output of 100,000 S.H.P. is used, and considerable ingenuity has been displayed in getting the turbines and the high-pressure boilers into the machinery space. The principal armament of the new vessels includes eight 6in. guns arranged in four turrets, and six 3·9in. anti-aircraft guns, together with machine guns and torpedo tubes.

Smoke Abatement Experiments.

UNDER the Smoke Abatement Act, 1926, local authorities are empowered to frame by-laws prescribing limits to the colour, density and composition of industrial smoke. A few attempts have been made to draw up by-laws of this kind. They have, however, failed in their purpose because the scientific information available concerning the measurement of relative smoke values was not sufficient for the purpose of establishing a specific definition of what constitutes a smoke nuisance. In particular, a keen want is felt for a simple optical method of judging the relative densities of smoke. The Ministry of Health has approached the Department of Scientific and Industrial Research on the subject, and that Department, in turn, has remitted the question to the Fuel Research Station at Greenwich. Experiments on the measurement of the opacity of smoke have already been carried out at Greenwich, but they have been confined to the smoke issued by one design of boiler. The station will now extend its researches to the smoke produced by several types of boiler and by these boilers when fired by different methods. The specific object of the investigations will be to establish an optical method of measuring the density of smoke. It is by no means certain that such a method of a satisfactory kind will be found. The opacity of smoke is not dependent solely on the degree of concentration of the particles composing it, but is also affected by the size of the individual particles, their colour and the manner in which the light falls on them. There may, therefore, be no close relationship between the figures given by the optical measurement of smoke and its dirtiness or its legal offensiveness.

Steam Locomotive Building at Dalmuir.

OWING to the currency of several misleading reports with regard to the future of William Beardmore and Co.'s locomotive department at Dalmuir, the firm has authorised the publication of an official statement of the position. The existing contracts for steam locomotives are almost completed, and as under the present conditions it has not been found possible to obtain orders for steam locomotives at economic prices, there will be no more work in the locomotive department. So far as the construction of steam locomotives is concerned, the department will be closed down permanently. Arrangements will, however, be made to deal with any electrical work which may be offered, and, as is well known, the firm is continuing to manufacture its high-speed oil engines for locomotive work. The decision which has been made is, we understand, part of the declared policy of the company to concentrate its activities on other and much more important branches of activity, for which, happily, there is a very gratifying amount of work in hand.

Electricity in Mines.

THE report for the year 1929 of the Electrical Inspector of Mines shows that during the period covered there were eleven fatal accidents, attributable either directly or indirectly to the use of electricity, involving the loss of nineteen lives, and injury more or less serious to five other persons. One of these accidents occurred upon the surface and the remaining below ground. Ten of the accidents were cases of electric shock resulting in one death in each accident and injury to one other person in one instance. The remaining accident was an explosion of firedamp, caused by open sparking in a coal-cutting machine, and resulted in the loss of nine lives and injury to four other persons. Of the electric shock accidents, three arose from damage to trailing cables; three were attributable to defects in plug connectors associated with trailing cables; in one, a coal-cutting switch broke down; in another, the tank of an oil switch fell away or was lowered so as to expose the live contacts; and in another a small motor was put into service in an unfit condition. All these accidents occurred below ground. The accident upon the surface arose from a misunderstanding over the telephone before cleaning insulators on the steel structure of an open-air transforming sub-station supplied by two 11,000-volt transmission lines, one of which was alive. In two of the accidents arising from failure in plug connectors, subsequent tests showed that the resistance in the earthing circuit was excessive. No accidents were reported in connection with the use of electricity in quarries.

Barclay, Curle and Co.'s New Chairman.

AT the luncheon which followed the recent launch of the motor ship "Macdhui" at Barclay, Curle and Co.'s shipyard at Glasgow, Mr. H. H. Glass, a director of the company, announced that Mr. Archibald Gilchrist had been asked by his co-directors to become chairman of the company, in succession to Mr. T. E. Thirlaway, who retired at the end of the year. The appointment will come up for confirmation at the next meeting of the company. In replying to the toast of the builders of the "Macdhui," which was proposed by Mr. James Burns, the chairman of Burns, Philip and Co., Ltd., of Sydney, for whose Pacific service the ship has been built, Mr. Gilchrist said that he was proud to recall the fact that Barclay, Curle and Co. were the second oldest firm of shipbuilders in Great Britain. His grandfather and father were both chairmen of the company, and their period of service as chairmen extended over thirty years, from 1887 to 1917.

Naval Construction in 1930.

IN spite of diplomatic efforts to restrict the production of naval material, the past year was one of considerable activity in the shipyards and arsenals of every great maritime Power save Great Britain. That was, perhaps, the inevitable result of a Naval Treaty which, while severely limiting British naval armaments, left the other signatory Powers at liberty to continue the development of their fleets up to a certain maximum of strength, and from which the sea forces of the two leading continental Powers were entirely excluded. This is not the place to comment on the London Naval Treaty, but it is difficult to escape the conclusion that we have been committed to a very one-sided bargain and have given away vital assets without receiving anything in return.

The British Empire.

By a decision reached at the Naval Conference held in London during the early months of 1930, the replacement of capital ships authorised in the Washington Treaty of 1922 has been postponed, and no vessels of this type will be laid down before 1936. As another Naval Conference is projected for that year, it is quite possible that the building of such ships will again be deferred. They may even be abolished by international agreement, though responsible naval opinion at home and abroad still regards the capital ship as an indispensable unit, and it is well known that several admiralties have prepared tentative designs for ships which, if built would eclipse the "Nelson" and "Rodney" in fighting power. For years to come, however, those two vessels must continue to rank as the strongest capital ships afloat, though it is eight years since their keels were laid. They constitute the spearhead of our battle fleet, which, in accordance with the London Treaty, will shortly be reduced to fifteen units by the scrapping of five ships—the four "Iron Duke" battleships and the battle-cruiser "Tiger." With these ships will go the last 13·5in. guns mounted in the British Navy, and henceforth 15in. and 16in. guns will comprise the main armament of the battle fleet. It is exceedingly doubtful whether guns of heavier calibre will ever be mounted afloat.

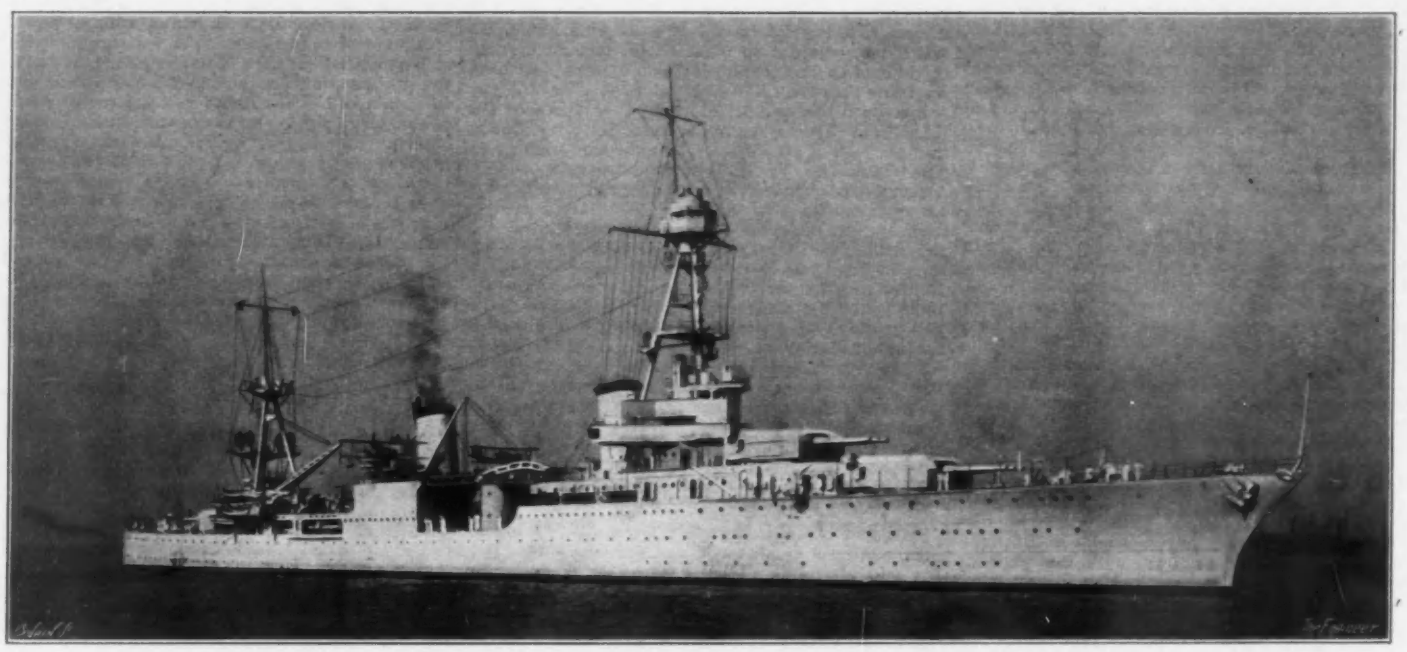
No aircraft carrier is either building or projected for the British Navy, though several vessels of this type are under construction abroad. The building of heavy cruisers has also ceased in this country, and upon the completion of the "Exeter," now being prepared for sea at Devonport, we shall have no warship exceeding 6500 tons displacement on the stocks. Had the five-year building programme approved by Parliament in 1925 been duly executed, the British Empire, a year or two hence, would have possessed sixteen cruisers of 10,000 tons and seven of 8400 tons, all armed with 8in. guns. As it is, however, we are restricted to thirteen ships of 10,000 tons and two of 8400 tons, mounting 116 guns of 8in. calibre. On the other hand, the United States programme provides for eighteen ships of 10,000 tons, mounting 164 guns of 8in. calibre. The discrepancy between the heavy cruiser tonnage and gunpower of the two fleets will thus be very marked, and is difficult to reconcile with the principle of "parity."

"Dorsetshire" and "Norfolk," our last ships of the 10,000-ton "County" group, were both commissioned in the past year. Only in unimportant details do they differ from the "Kents" and "Londons," which have been exhaustively described in THE ENGINEER. In all these vessels the shaft horse-power has remained constant at 80,000, but improvements in the form of hull have given the later ships a slightly higher speed, and it is noteworthy that in every case the contract speed has been attained or surpassed without exceeding the specified S.H.P. H.M.S. "York," the first of the "B" class, was commissioned during the past year after very successful trials. She marks a welcome departure from the conventional and rather unimaginative 10,000-ton design, which was universally adopted after the Washington Conference. The displacement has been reduced to 8400 tons, the main armament from eight 8in. guns to six, and the cost from £2,000,000 to about £1,600,000. Machinery of 80,000 S.H.P. is installed, but owing to her reduced length the speed of the ship, notwithstanding her smaller displacement, does not exceed that of the 10,000-ton cruisers. In the original design of the "York," three funnels were provided. Subsequently, however, it was found possible to eliminate the foremost of these by trunking the forward boiler uptakes into the second funnel. The appearance of the ship is somewhat marred by the unequal size of the two funnels. Apart from this, the design is an admirable one in all respects, and but for Treaty restrictions, we should probably have built many more "B" class cruisers, which for service with the Fleet or for trade protection duties could hardly be bettered. It was proposed to equip the "York" with two aircraft—a seaplane mounted on a catapult on the crown of the second turret, and an aeroplane on a second catapault placed amidships; but as the turret proved unequal to the stresses set up by the discharge of the catapult, the seaplane has had to be dispensed with. H.M.S. "Exeter," second and last of the "B" class, corresponds to the "York" in tonnage and dimensions, except that the beam has been increased from 57ft. to 58ft. In contrast to "York," her funnels and masts have no rake, and the height of the bridge has been reduced. With their bunkers filled to capacity—1900 tons of fuel oil—both ships will have a cruising radius of 10,000 miles at speeds ranging from 11 to 14 knots.

H.M.S. "Codrington," our first flotilla leader to be built since the war, was completed in June, having been launched by Swan, Hunter and Wigham Richardson, Ltd., at Wallsend, on August 7th, 1929. The leading particulars are as follows:—Length, 332ft.; breadth, 33ft. 9in.; displacement, 1520 tons; geared turbines of 39,000 S.H.P., Yarrow boilers working at 300 lb. pressure; designed speed, 35 knots. According to "Fighting Ships," the "Codrington" on her trials maintained a mean speed of 38 knots for four hours, reaching 40 knots at times. "At no time was the machinery pressed in any way, in conformance with Admiralty instructions. If maximum power had been worked up, this ship would have achieved record figures." Assuming this account to be correct, the performance of the "Codrington" reflects high credit on her designers and builders. A second flotilla leader, the "Keith," was launched by Vickers-Armstrongs at Barrow-in-Furness in July; a third, the "Kempenfelt," is under construction by J. Samuel White and Co., Ltd., at Cowes; and a fourth, the "Dundan," is shortly to be started at Portsmouth.

All eight destroyers of the "Acasta" class, built under the 1927 Navy Estimates, are now in service. They constitute the first group of British destroyers to be completed since the war, following the experimental boats "Amazon" and "Ambuscade," which were ordered in 1925. The displacement is 1330 tons, the machinery develops 34,000 S.H.P., the speed is 35 knots, and the armament comprises four 4·7in. guns and eight 21in. torpedo tubes on two quadruple mounts—the heaviest torpedo armament yet mounted in British destroyers. They are exceptionally handsome vessels, the two funnels of equal height and girth giving them a symmetrical profile in pleasing contrast with that of earlier destroyers. Eight more boats, "Beagle" class, were launched during the year, all from Northern yards, and are practically identical with the "Acasta" design. Of the eight destroyers projected under the Estimates for 1929, four were cancelled, and of the remaining four, "Crusader" class, two are building at Portsmouth and two by Vickers-Armstrong. Destroyer contracts under the current Estimates have been awarded as follows:—"Defender" and "Diamond," Vickers-Armstrongs; "Daring" and "Decoy," Thornycrofts; "Dainty" and "Delight," Fairfield Shipbuilding Company; "Diana" and "Duchess," Palmer's Shipbuilding Company. In each case the contract includes hull and machinery.

Two destroyers, "Saguenay" and "Skeena," destined for the Royal Canadian Navy, were launched at Thornycroft's Yard, Woolston, on July 12th and October 10th, respectively. In general design and measurements they follow very closely the "Acasta" class, but to suit the requirements of the Canadian service the scantlings have been strengthened an sufficient stability provided to withstand any accumulation of ice on the upper decks, bridges, &c. These destroyers, we gather, embody several "surprise" features, some due to the builders and others to the Canadian technical authorities, and many of them, it is predicted, will be found before long in destroyers of the Royal Navy. Recent British destroyers have all been of a uniform Admiralty design. While this produces complete homogeneity of flotillas, progress is likely to be less rapid than when builders are encouraged to put forward special designs of their own, as in the case of these Canadian craft.

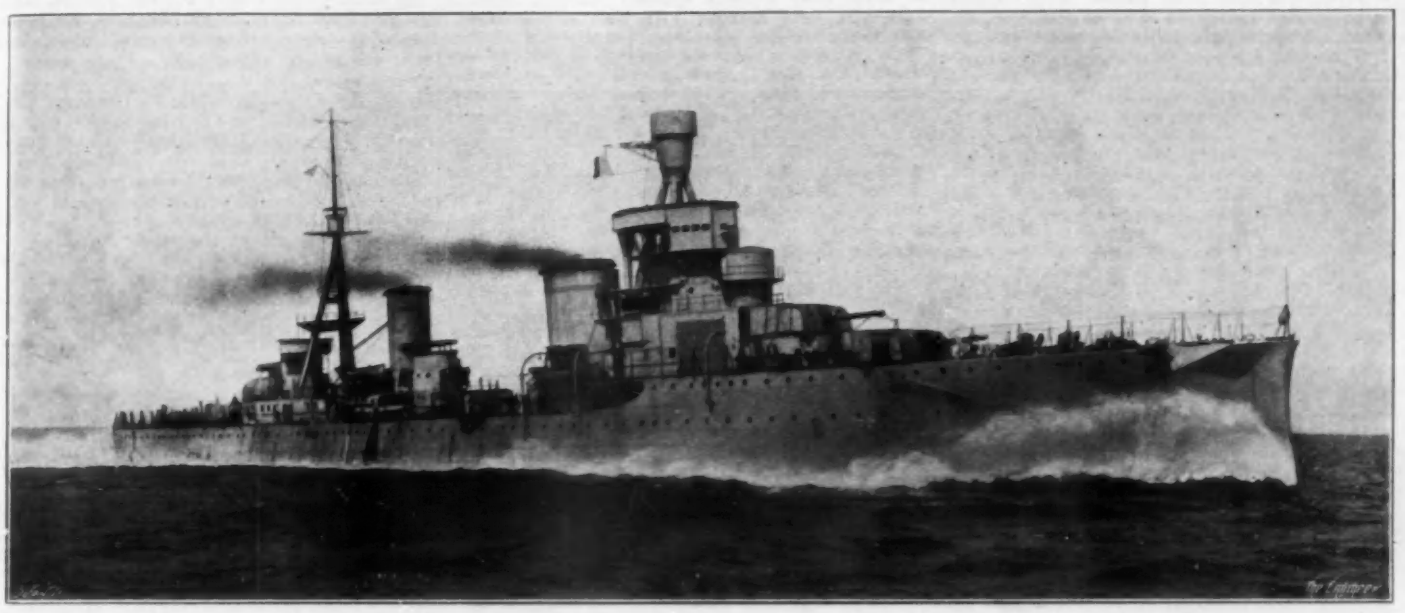


THE U.S. 10,000-TON CRUISER "HOUSTON"

Four submarines, "Rainbow," "Regent," "Regulus," and "Rover," were launched during the year. Laid down under the Estimates for 1928, they are very similar to the six "P" class boats of the 1927 programme, having the same surface displacement of 1475 tons and a speed of 17¼ knots. Like the "O" class, authorised in 1926, they were designed with a view to service overseas. They have good seagoing qualities, and as regards space and ventilation the berthing accommodation is excellent. Including the Australian units "Oxley" and "Otway," we have now built nineteen of these fairly large post-war submarines. Three more boats have been ordered under the Estimates for 1929, but of different types. The first, to be named "Thames," is a minelaying submarine of 1800 tons; the second and third, to be known as "Swordfish" and "Sturgeon," are comparatively small craft of 650 tons. The latter may possibly be an improved version of the "H" class submarines, which, in spite of displacing only 410 tons, have always been safe, handy, and popular boats. The "Thames" will be the second largest underwater craft built in this country, her displacement being excelled only by that of the "X 1." Another minelaying submarine, the "Porpoise," and two 650-ton boats, "Starfish" and "Seahorse," belonging to the 1930 programme, have been ordered.

Good progress is being made with the building of new sloops to replace the older vessels of this type, which are becoming obsolete. Ten have been com-

pleted or laid down up to now, and four others are to be laid down before the end of the financial year. The displacement is 945 tons, the speed 16 to 16½ knots, and the armament two 4in. guns on high-angle mountings. These vessels are, no doubt, of considerable value for miscellaneous service on the foreign stations, where, it has been officially admitted, they are intended to eke out our meagre establishment of cruisers. But in tonnage and in other respects they do not compare favourably with the sloops under construction for other navies, particularly the new French "avisos," which are Diesel-driven ships of 2000 tons, with a wide radius of action and a battery of three 5·5in. guns. The "Hindustan," a slightly larger version of the Royal Navy sloops, was launched by Swan, Hunter and Wigham Richardson at Wallsend on July 10th.



THE ITALIAN LIGHT CRUISER "ALBERTO DI GIUSSANO"

United States.

Although the United States is entitled by the London Treaty to the possession of eighteen 10,000-ton cruisers, it is not proposed to build up to this establishment in the immediate future. The position to date is as follows:—Five ships—"Salt Lake City," "Pensacola," "Chester," "Houston," "Northampton"—are in commission; three—"Louisville," "Chicago," "Augusta"—are completing afloat; five—"Portland," "Astoria," "Minneapolis," "New Orleans," "Indianapolis"—are on the stocks; and two others—"CR 37" and "CR 38"—were ordered recently, bringing the total to fifteen ships. The three remaining ships are to be laid down in 1934, 1935 and 1936 respectively, so that the maximum number authorised by the Treaty will not be reached before 1939. The "Salt Lake City" and the "Pensacola" are in a class by themselves, their design reflecting the traditional American policy of mounting the heaviest possible armament on a given displacement. They are flush-decked ships, 585½ft. in length overall, with a beam of 64ft. The propelling plant consists of Parsons geared turbines taking steam from eight boilers of the White-Forster pattern, working at 300 lb. without superheat, the total weight of the plant being 2161 tons, and the contract output 107,000 S.H.P. for a speed of 32½ knots. Ten 8in. 55-cal. guns are mounted in two triple and two twin turrets, the triple turrets being placed in rear of and above the two-gun positions. This arrangement, which is dictated by the lay-out of the magazines—the ships have very fine extremities—involves the carrying of heavy weights above deck level, and is said to make the vessels very lively at sea. Armour plating is flimsy, and these two cruisers are probably less well protected than our "County" ships. In the later American ships a raised forecastle is provided, the overall length is increased to 600ft., and the beam to 65ft., while the armament is reduced to nine 8in. guns in triple turrets, two forward and one aft. During their two-hour maximum steam trials, "Salt Lake City" average 109,657 S.H.P. and 32·77 knots; "Chester," 109,000 S.H.P. and 33·08 knots; "Northampton," 111,302 S.H.P. and 33·17 knots; and "Houston," 109,849 S.H.P. and 33·15 knots.

Two more of the large "V" class submarines, "Nos. 5" and "6," were completed during the year. They are the largest of the class yet built, each being 371ft. in length, with a surface displacement of 2760 tons. The surface speed is 17 knots. Two 6in. guns are mounted, and there are six torpedo tubes. These vessels are apparently deemed too heavy or too expensive to be perpetuated, for the "V 7," laid down in June, is to displace only 1560 tons, the length has been curtailed to 319ft. and the armament reduced to one 4in. gun and six tubes. No other construction of importance is in hand, but the new programme, which has yet to pass Congress, embraces the following:—One 10,000-ton cruiser, fitted with a flight deck and generous accommodation for aircraft, to be armed with 6in. guns; one 7500-ton cruiser with 6in. guns; one aircraft carrier of 13,800 tons; one destroyer leader of 1850 tons; ten destroyers of 1500 tons; four submarines of 1100 tons. The cruisers are acknowledged to be experimental in design and will not be repeated unless their trials prove satisfactory. It deserves to be recorded that the London Naval Treaty, while restricting future British 6in. gun cruisers to 6500 tons or thereabouts, leaves the United States free to build 6in. ships up to 10,000 tons.

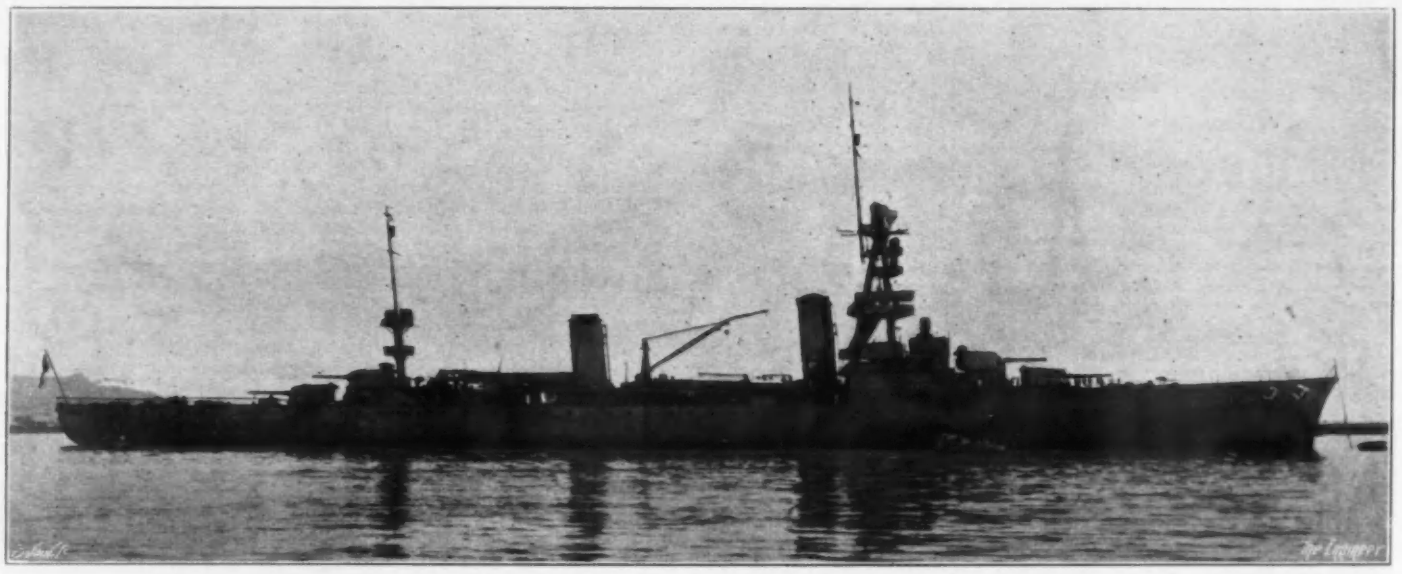
THE FRENCH 10,000-TON CRUISER "COLBERT"

Japan.

The Treaty establishment of twelve heavy cruisers will be attained in the near future. Up to the present date there have been completed four 7100-ton ships—"Kako," "Furutaka," "Kinugasa," "Aoba"—and four of 10,000 tons—"Nachi," "Myoko," "Ashigara," "Haguro." Of the remaining 10,000-tonners, "Takao" and "Atago" were launched in May and June respectively, while the "Chokai" and "Maya" will go afloat early this year. The 7100-ton type has an armament of six 8in. guns, but the larger vessels carry ten of these weapons, and are thus equal in weight of broadside to the American "Salt Lake City" class. The new cruisers have the characteristic Japanese outline, with an undulating hull line, massive bridges, and trunked funnels. All twelve ships are able to steam at 33 knots. The minelayer "Itsukushima," of 1970 tons, launched in May, 1929, has been completed. She is propelled by I.C. engines totalling 3000 B.H.P., which give her a speed of

17 knots. The counter, square and overhanging, is pierced with four ports for dropping mines. Three 5·5in. guns are mounted on the centre line. This is the first Japanese warship of considerable tonnage to be fitted with internal combustion machinery. The twenty-four large destroyers of the "Fubuki" class, several of which are still incomplete, call for some notice. Displacing 1700 tons, they have turbines of 50,000 S.H.P. for a speed of 35 knots. The freeboard is high, the funnels are large, and the upper works lofty, giving the vessels a most formidable appearance. The guns, six in number and variously reported to be 4·7in. and 5·1in., are paired in closed gun houses—a decided innovation so far as destroyers are concerned. Nine torpedo tubes are mounted. No to be laid down at the rate of one per year. Their completion will raise the total of French 10,000-ton cruisers to twelve.

The aircraft tender "Commandant Teste," of 10,000 tons and 20 knots speed, is practically complete. As no flight deck is fitted, the seaplanes will be discharged by catapult and retrieved from the water by derricks, five of which are provided. This ship bears a family resemblance to the "Albatross," the Australian Navy's new seaplane carrier. The "Jeanne d'Arc," launched at St. Nazaire last February, is officially classed as a training ship, though she is at the same time a useful cruiser. Length, 525ft.; beam, 57ft. 6in.; draught, 17ft. 9in.; displacement, 6600 tons; turbine machinery, 32,500 S.H.P., for with a beam of 29ft. 6in. A surface speed of 18 knots is expected from the twin Diesels of 7600 B.H.P. The vessel will carry two 8in. guns, probably in turrets, and fourteen torpedo tubes, with a supply of thirty-six torpedoes. The crew will number 150. The trials of this immense submarine are awaited with interest. She will, it is stated, have a radius of 10,000 miles at moderate speed. Most of the other submarines now building are of standardised type, 1384 tons on surface, 18 knots speed, armed with one 3·9in. gun and eleven tubes. Those already completed have proved most successful. They have made long independent cruises without mishap, and the designed speed has in several instances been exceeded. One of the class "Henri Poincaré," maintained an



THE FRENCH 10,000-TON CRUISER "SUFFREN"

other torpedo vessels now afloat can compare with the "Fubuki" class for weight of armament in proportion to tonnage. Five submarines of 1638 tons are under construction, but other details are lacking.

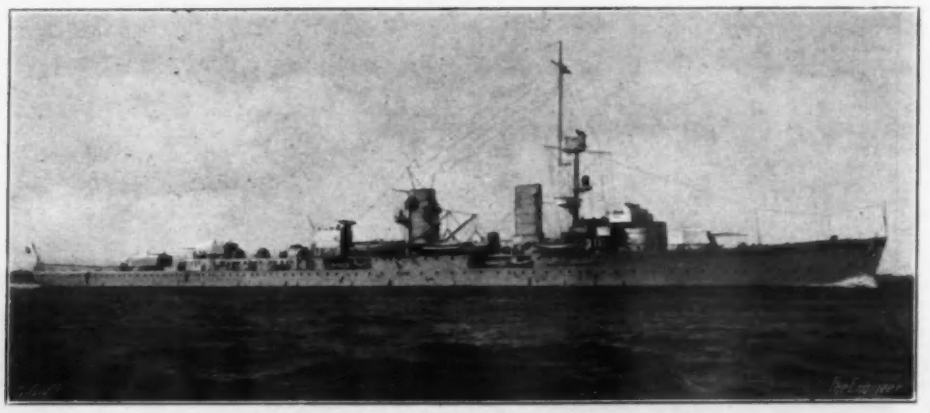
France.

Many additions were made to the French Navy in the course of the year, the most notable being the 10,000-ton cruisers "Colbert" and "Foch" and several of the huge flotilla leaders which have become so popular with that service. Before considering these vessels, it will be useful to detail the number and types of units which have been authorised in France from 1922 to the present date, viz.:—Seven cruisers of 10,000 tons, armed with 8in. guns; three cruisers of 8000 tons, with 6in. guns; one training cruiser, of 6600 tons; one mine-laying cruiser, of 4850 tons; thirty flotilla leaders; twenty-six destroyers; one submersible cruiser, forty fleet submarines, six mine-laying, and twenty-seven coastal submarines; one surface mine-layer; one aircraft carrier and one seaplane tender; one submarine depôt ship, five oil-tankers, six colonial gunboats, one river gunboat, one net-layer, and one submarine chaser. Within the space of nine years, therefore, provision has been made for 160 new vessels, including 74 submarines. It would be difficult to trace any previous period of history in which French naval power has developed so steadily and progressively as in the years since the Great War. Ships of various types, grouped together in homogeneous classes—each group marking an advance in technical efficiency over the previous batch—are ordered, laid down, and completed according to schedule. In spite of the handicap of frequent Cabinet changes, there has been admirable continuity in French naval policy throughout the post-war period, and designers and engineers have received every encouragement to exert their native ingenuity. The result is seen in the magnificent fleet which France is already able to muster, a fleet that will be steadily reinforced as the programme approaches maturity.

The 10,000-ton cruisers "Colbert" and "Foch"—sisters to the "Suffren," completed in 1928—which began their trials in the year under review, are somewhat slower than the first vessels of this type, "Duquesne" and "Tourville," but have superior armour protection. The main armament—eight 8in. guns—is unchanged, and each ship has three seaplanes, discharged by catapults, in place of the two carried in the earlier units. The "Dupleix," launched at Brest in October, belongs to the same class. In the "Algérie," begun early in December, important modifications will be introduced. Protection is to be improved by a slight sacrifice of speed, and one large funnel casing will contain all the boiler uptakes. Moreover, the 8in. guns are of a new and longer model, and the anti-aircraft battery is increased to eight 4in. pieces. It is proposed to build five further ships named after French Colonies, viz., "Madagascar," "Maroc," "Tunisie," "Indo-Chine," and "Senegal," 26½ knots; armament, eight 6·1in. guns in twin turrets, four 3in. A.A., and two torpedo tubes; the armour protection is scanty. Two seaplanes are included in the equipment. Another special ship completed last year is the cruiser-minelayer "Pluton," of 4850 tons and 30 knots speed, armed with four 5·5in. guns. Work was begun on the first two colonial "avisos," or sloops, of which it is proposed ultimately to build twelve. They are of respectable size, 334ft. in length and 44½ft. in beam, displacing 2000 tons. The machinery consists of two sets of internal combustion engines, developing 3200 B.H.P., the speed being 15½ knots. At lower speeds the radius will be 10,000 miles. They carry three 5·5in. and several small guns, together with a seaplane. Craft such as these are much more suitable for duty overseas than our tiny sloops of the "Sandwich" class.

Twelve large flotilla leaders have now been completed, and eighteen further ships of this type are under construction. From the "Chacal" class, of 2362 tons, begun seven years ago, the displacement has gradually risen to 2570 tons, the speed from 35½ to 38 knots, and the armament from five 5·1in. to five 5·5in. guns. All these craft have exceeded their designed speeds, the "Bison" at present holding the record with 41·2 knots. They constitute a torpedo flotilla which for mobility and fighting power has no counterpart in any other navy.

Submarine launches were frequent during the year. So far as can be ascertained, twenty boats are now in various stages of construction. Among them is the "Surcouf," the world's largest submarine, which was launched at Cherbourg in November, 1929. Displacing 2880 tons on the surface and 4300 tons when submerged, she is nearly 400ft. long, average of 17·6 knots for forty-eight hours on her official trials.



THE GERMAN LIGHT CRUISER "KOLN"

Italy.

The development of the Italian Navy continues to be rapid and systematic. With the launch of the "Zara" and "Fiume," both on April 27th last, there are now four 10,000-ton cruisers afloat. The two ships named differ materially from the "Trento" and "Trieste," completed in 1928, the speed having been reduced from 35 knots to 32, and the armour protection substantially increased. Two similar ships, "Gorizia" and "Pola" were laid down recently, but in another unit, "Bolzano," also on the stocks, the speed has again been raised, this time to 35·5 knots. Italy, it will be seen, already has seven 10,000-ton cruisers built or building, this being equal to the French total. Widespread interest has been awakened by the completion of the first ships of the "Condottieri" class, a type of light cruiser which appears to have been specially designed for Mediterranean operations and as a "reply" to the big French flotilla leaders. The "Giovanni delle Bande Nere" and her seven sisters are truly remarkable vessels. The first three, built at the Ansaldo yard, have taken little more than two years to complete. Particulars of the class are as follows:—Length over all, 554ft.; beam, 51ft.; draught, 14ft.; standard displacement, 4896 tons (5009 tons in the last four); machinery, two sets of geared turbines, six oil-burning boilers, S.H.P. 96,000 for 37 knots; radius of action at 25 knots, 2500 miles; armament, eight 6in. guns in twin turrets, six smaller pieces, four torpedo tubes. The "Alberto di Giussano," one of the Ansaldo

group, running her trials on a displacement of 5607 tons, is reported to have reached 40·7 knots, and, with her full armament on board, to have maintained 39·8 knots over a course of 160 miles—a truly astonishing performance. Hull and machinery are understood to be of very light construction, and, without any desire to detract from the fine technical achievement they represent, we doubt whether the scantling will long endure the strain of such powerful machinery if the ships are frequently driven at high speeds. Nevertheless, for the time being these eight cruisers have no equal. They are fast enough to overtake the swiftest destroyer, and, with their powerful armament, they could engage any 6in. gun cruiser without undue risk. The twelve large destroyers of the "Navigatori" class are now completed. Displacing 1654 tons, they have a speed of 38 knots, and are armed with six 4·7in. guns and six tubes. Mines are carried by several boats of the group. Twelve later destroyers, of about 1240 tons each and designed for 38 knots, are being built. It will not have escaped attention that the latest cruisers and destroyers of the Italian Navy are designed for exceptionally high speeds, a policy which appears to be quite sound in view of the peculiar problems of strategy which confront Italy in the maritime sphere. Several large submarines went afloat during the year, and it is proposed to lay down at an early date no fewer than twenty-two new boats of varying types.

Other Navies.

The diminutive German battleship "Ersatz Preussen," which was begun at Kiel in September, 1928, will be launched in the New Year. As is well known, she is of 10,000 tons standard displacement and is driven by I.C. engines of 50,000 B.H.P. at a maximum speed of 26 knots. The hull is welded, and the machinery and other equipment has been constructed on weight-saving principles. She is to mount six 11in. guns in triple turrets fore and aft, eight 6in. guns, four 314in. A.A. and six torpedo tubes. The design is noteworthy in all respects, and of no other man-of-war now building is the completion awaited with so much interest. Should she turn out a complete success, she may exert a marked influence on the future development of warships, particularly with regard to their propulsion. It is proposed to construct three further ships of this type, to take the place of the obsolete battleships "Lothringen," "Braunschweig," and "Elsass." The only German naval unit to be completed during the year was the light cruiser "Köln," a sister to "Königsberg" and "Karlsruhe," previously placed in service. The standard displacement is 6000 tons, the machinery comprises steam turbines for high speeds—up to 32 knots—and an auxiliary I.C. plant for cruising purposes. Armament: Nine 5·9in. in triple turrets, one forward on the centreline, two aft *en échélon*; four 3·4in. A.A., and twelve deck torpedo tubes. The "Leipzig," fifth and last of the post-war cruiser series, is of the same generic design, but a more powerful I.C. plant is installed, the boiler uptakes are housed in a single large funnel, and the 5·9in. turrets are on the centreline.

Apart from some unimportant reconstruction work on old ships, and the laying-down of three submarines at the Baltic yard, Leningrad, there is nothing of interest to report concerning the Russian Navy.

For the Spanish Navy two 10,000-ton cruisers, "Baleares" and "Canarias," are on the stocks at Ferrol. The completion of these ships, which are to have a speed of 33 knots and a main battery of eight 8in. guns, promises to be considerably retarded for financial reasons. Four flotilla leaders, 1650 tons and 36 knots, and several submarines are building at Cartagena.

The Swedish "aircraft-cruiser" "Gotland," the first ship of her type, was begun during the year. She displaces 5260 tons, has turbines of 33,000 S.H.P. for 27 knots, and mounts six 6in. guns in turrets. The after part of the ship is reserved for seaplanes and two catapults are carried. In this original type we may discover the salient features of a convoy cruiser which would be eminently suited to British requirements.

The Chilean battleship "Almirante Latorre," after undergoing an extensive refit at Devonport, including new machinery, is now almost ready for her trials, and is due to leave for South America early in the year. The six "Serrano" class destroyers, built by Thornycroft's, the three large submarines and the submarine depôt ship "Araucano," all built by Vickers-Armstrongs, have been delivered. Complete satisfaction is expressed by Chilean naval officers with the performances of these craft.

The Argentine Government has taken delivery of the twin cruisers "Almirante Brown" and "Veintecinco de Maya," which were ordered from Italian yards and launched in August, 1929. They are handsome and, for their tonnage, very powerful vessels. Displacing only 6800 tons, they are able to steam at 32 knots. Six 7·5in. guns in double turrets, twelve 3·9in. A.A. guns, and six torpedo tubes, constitute the armament. Three flotilla leaders, "Mendoza," "Tucuman" and "La Rioja," of 1520 tons and 36 knots, have been completed for the Argentine Navy by J. Samuel White and Co., of Cowes. All bettered their contract speed, "Mendoza" and "Tucuman" maintaining 38 knots for 6 hours and "La Rioja" reaching 39·4 knots without exceeding the designed horse-power.

Many of the vessels mentioned in this review of the year are illustrated on pages 2, 3 and 4, and in one of our Supplements.

Electrical Engineering in 1930.

No. I.

Introduction.

LIKE other industries, the electrical industry was affected by the general trade depression experienced in this country during 1930, but special conditions protected it from the worst consequences of the slump. Fortunately, an unusually large volume of orders for heavy generating plant was obtained from overseas, whilst the Central Board's orders, including those appertaining to standardisation, represented a sum of no less than £11,000,000. A determined effort was made during the year to meet foreign competition, particularly in connection with wireless products, and something like boom conditions prevailed in this section of the industry during the latter part of the year. The application of the electric drive to marine propulsion added to the demand for generators and large motors and switchgear, but the main factors which served to keep the industry fairly active during the major portion of the year were the export and "grid" orders and the expansion in the demand for consumers' apparatus. Only during the last two months did the slump begin to make itself generally felt, but during the whole part of the period under review the demand on the part of home industry was at a very low ebb, notwithstanding that important orders were received from the motor car, and steel and coal mining industries.

The decision of the Southern Railway to extend its electrified system to Brighton and the extension of the London tube system from Finsbury Park to Cockfosters resulted in important traction orders being placed in the autumn of the year. The process of replacing electric tramcars by trolley omnibuses, notably in the North of England, also created a demand for new electrical traction equipment. The provision of new generating stations and extensions to existing stations was decidedly below normal. Extensions were confined very largely to the London area, and were not a feature of electrical advance in the country as a whole. Extensions at Barking, Deptford West, Willesden (North), and at Greenwich represented a very fair demand for generating plant. Outside London the most important extensions were those at Dunston, Ironbridge, Clarence Dock, Liverpool, and at Brighton, but whole sections of the country, notably the Midlands and Lancashire, were inactive during the year. The demand for consumers' apparatus, domestic appliances is said to have reached a record level.

Unfortunately, the Electricity Commissioners' statistical returns do not cover the period under review, and the Commissioners are unable to give the total amount of plant installed at the end of 1930. Some of the statistical returns, in fact, for the year 1929–30—the year ended March 31st, 1930, in the case of Local Authorities in England and Wales; May 15th for Scottish Local Authorities, and December 31st, 1929, for companies—are still outstanding; but the following figures may prove of interest:—The total capacity of plant installed up to the year 1929–30, exclusive of private plant, was 6,480,000 kW. Twenty-two stations were closed down during the year covered by the returns, and eleven new stations were put into operation. Two existing standby stations were re-commissioned, whilst twenty-four stations which had previously been operated on a non-statutory basis became part of authorised undertakings. Of the new stations put into commercial operation during 1930 there was only one of importance, namely, the Chadderton station of the Oldham Corporation. The Kearsley station of the Lancashire Electric Power Company, which is equipped with B.T.H. plant, attained the highest thermal efficiency, *i.e.*, 24·36 per cent., recorded for steam stations in the Commissioners' returns.

Electricity Schemes.

During the year three further electricity schemes were adopted by the Central Electricity Board. They cover North-East England, South-West England and South Wales and East England respectively, whilst a scheme for South Scotland was submitted to the Board. The eight schemes adopted and the South Scotland scheme which was published during the year cover the whole of Great Britain, with the exception of North Scotland. The North-East England scheme adopted by the Board on January 24th, 1930, covers an area of 5050 square miles with a population of 2,674,800, and comprises the counties of Northumberland and Durham and a part of the North Riding of Yorkshire. It serves densely populated areas in which the important industries of coal mining, shipbuilding, iron and steel engineering and chemical trades are carried on, as well as considerable areas of agricultural and grazing land, and includes the areas of supply of thirty-two authorised undertakers. Of the fifteen public generating stations in the area, six have been selected, whilst five more stations may be operated under temporary arrangements. Associated with the main and secondary transmission systems there will be six main transforming stations and seven secondary transforming stations. The greater part of the electrical development of this area has been carried out at a non-standard frequency of 40 cycles, and the scheme aims at altering the frequency of twenty-five authorised undertakings to 50 cycles per second.

The South-West England and South Wales scheme adopted by the Board on June 3rd, 1930, covers an area of 17,234 square miles with a population of 6,085,500, and includes the densely populated areas in the coal mining districts, the important maritime towns of Southampton, Plymouth, Falmouth, Bristol, Newport, Cardiff, and Swansea, and other industrial districts to the south-east of the Bristol Channel. Under the scheme seven stations have been selected and provision has been made for the erection of two new selected stations. Temporary arrangements may also be made for operating ten other stations. Associated with the main and secondary lines there will be eleven main transforming stations and fourteen secondary transforming stations. The scheme provides for the standardisation of the frequency of twenty undertakings at 50 cycles per second.

The East England scheme adopted by the Board on August 8th, 1930, includes practically the whole of the counties of Norfolk and Suffolk and covers an area of about 3438 square miles with a population of 788,880. Two generating stations have been selected under the scheme and temporary arrangements may be made with them and a third station. Three main and two secondary transforming stations will be associated with the main and secondary transmission lines. In this case the scheme does not provide for the standardisation of frequency.

Constructional work on the eight schemes proceeded rapidly during the year, and in Central Scotland twelve main transforming stations and over 250 circuit miles of 132-kV overhead lines are now in operation. The remaining route from Abernethy to Dundee will be brought into use at an early date, thus completing the main transmission system of this scheme. At the end of April Mr. Herbert Morrison, the Minister of Transport, officially opened the Central Scotland electricity scheme, and on the same occasion important extensions at the Portobello generating station were put into service. The 60,000-kVA transformer bank at the Dalmarnock sub-station and the Luton sub-station are illustrated in one of our Supplements, whilst Figs. 4 and 5 show the Brighton and Portobello sub-stations respectively.

In South-East England seven 132-kV and three 66-kV main transforming stations and ten secondary transforming stations are in operation, with 108 circuit miles of 132-kV transmission lines, 4·5 circuit miles of 66-kV cable, and 103·6 circuit miles of secondary transmission lines. In Central England one secondary transforming station and 15·6 miles of double-circuit line are in use, and in North-West England four secondary transforming stations and 119 miles of secondary transmission lines. So far the value of the orders placed for transmission lines and transforming stations is over £18,000,000.

Generating Plant.

Of the turbo-generator sets built or under construction during the year a 30,000-kW B.T.H. three-cylinder machine designed for a pressure of 1200 lb. per square inch and a total temperature of 725 deg. Fah. is one of the most interesting. In the high-pressure cylinder the steam is expanded down to 200 lb. per square inch and a large part of the steam at this pressure is to be exhausted for process work in the new Ford motor factory at Dagenham, where the set is to be installed. The speed of the turbine, which is built on the impulse principle throughout, is 3000 r.p.m. The 10,000-kW 3600 r.p.m. B.T.H. set for the Delray power station of the Detroit Edison Company, designed for a pressure of 365 lb. per square inch, a total temperature of 1000 deg. Fah., and a vacuum of 29in., is now in operation, but at the time of writing the high-temperature superheater is not quite ready. The turbine to which we have often referred is a two-cylinder machine, and the extra high temperature is confined to one cylinder. Three-point extraction is provided for giving a final feed water temperature from the last heater of 312 deg. Fah. at a load of 8000 kW. The manufacture of the B.T.H. 67,200-kW turbo-alternator for the Battersea power station of the London Power Company is nearly completed, but it will probably be some little time before the station is ready to receive it, for, as indicated in an article appearing in our issue of November 14th, the building is still very far from complete. We give in Figs. 1 to 3 on page 6 views of the pump house under construction, of the inside of the suction chamber, and of the Thames cable tunnel. Another large machine in the course of manufacture at the B.T.H. works is a 50,000-kW set for the Ironbridge power station of the West Midland Joint Electricity Authority. Designs were prepared by the B.T.H. Company for a 50,000-kW 3000 r.p.m. machine, the designs being such that even at that rating the problems that have to be faced as regards stresses in the rotating discs are no more difficult than those met with in machines of much smaller capacity. As regards the electrical end of B.T.H. sets, it is

THE BATTERSEA GENERATING STATION OF THE LONDON POWER COMPANY

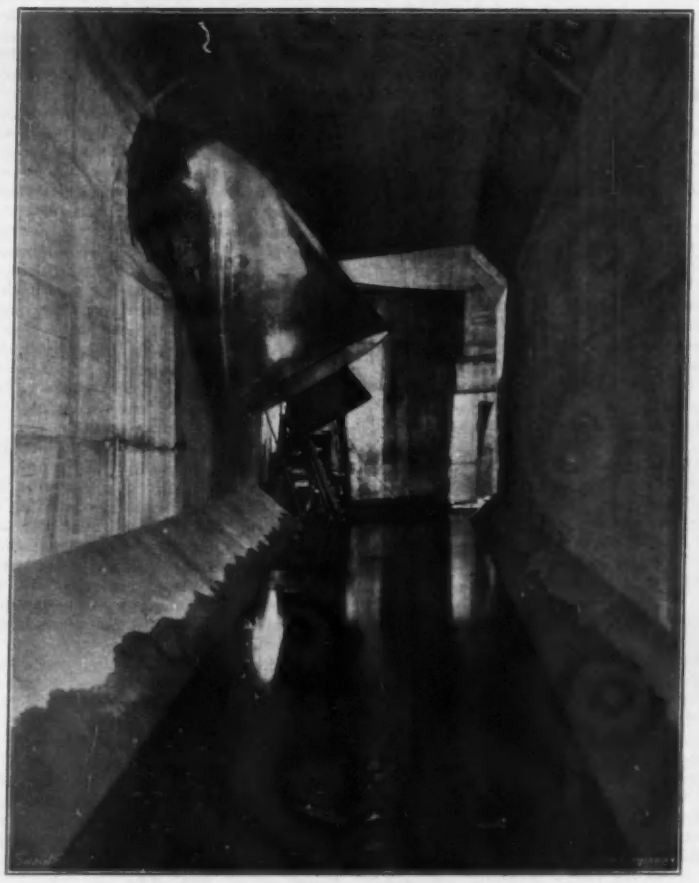


FIG. 1—INTERIOR OF CIRCULATING WATER SUCTION CHAMBER

FIG. 2—CABLE TUNNEL UNDER THE THAMES

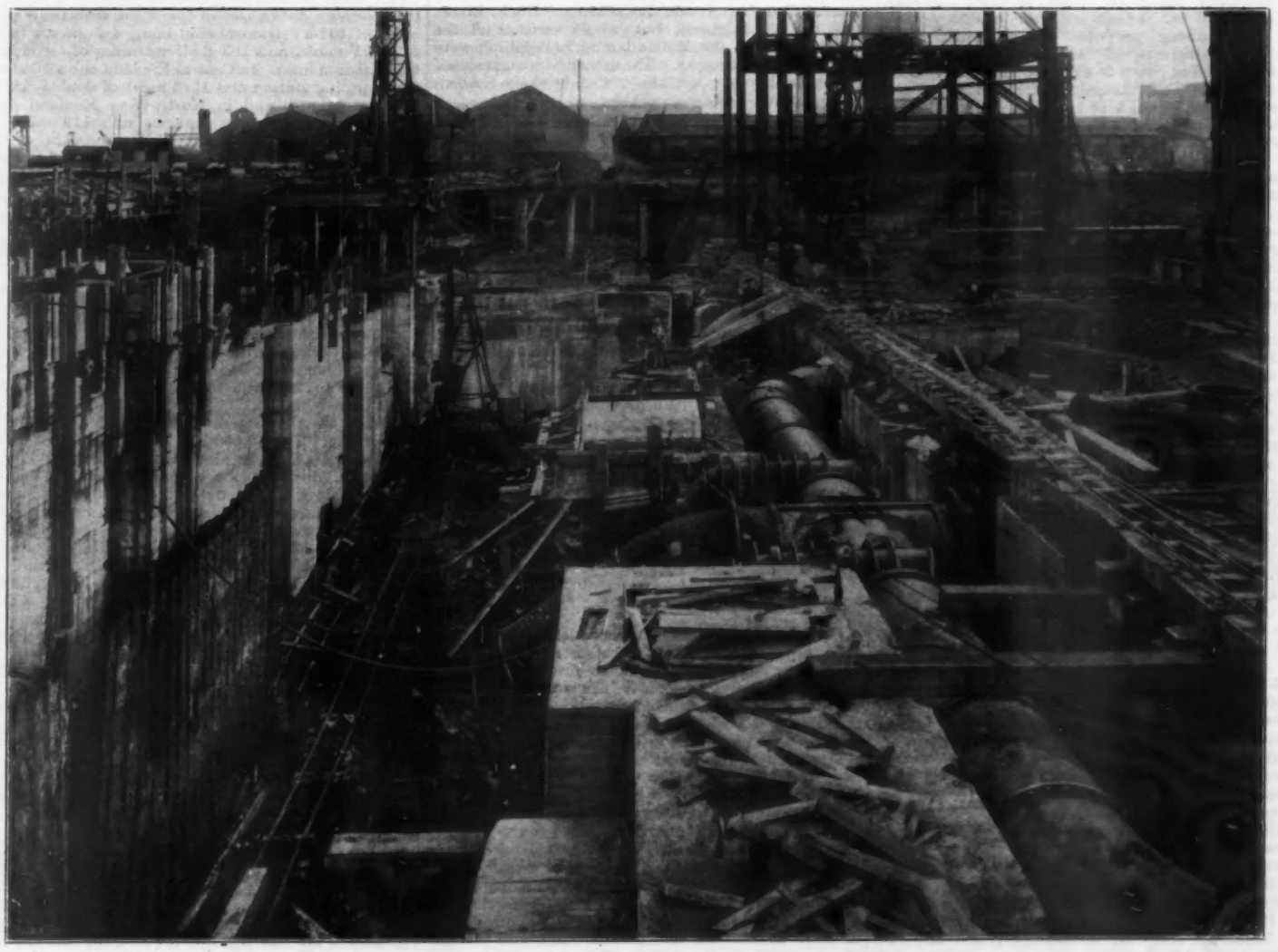


FIG. 3—CIRCULATING WATER PUMP HOUSE UNDER CONSTRUCTION

interesting to note that two 9400-kVA 3000 r.p.m. machines wound for 14,000 volts have been constructed, whilst an example of the other extreme as regards voltage and current is a 4700-kVA machine wound for 220 volts. Last year we referred to the B.T.H. system of building large alternators with a separate ventilating blower unit, directly driven from the end of the shaft, and we understand that this system of ventilation continues to meet with favour. A 45,000-kVA 3000 r.p.m. 11,000-volt machine of this kind in the B.T.H. works is believed to be the largest turbo-alternator designed for that speed now in course of construction in Great Britain. The practice of absolute and will then be returned to a reheater and be superheated to 800 deg. Fah., the steam then passing to a low-pressure turbine of the single-flow reaction type and finally exhausting at an absolute pressure of 1in. mercury. The alternators will generate at 13,500 volts and each machine will consist of a single-line unit running at 1500 r.p.m. Orders for generating sets were received from Denmark, South Africa, and Canada. The application of the latest Parsons' oil relay operated pass of governor was applied during the year to a machine on which two bleeding parts on the turbine are maintained at constant pressure. The set, which is rated at 3750 kW, world-wide interest that this remarkable undertaking has created.

The General Electric Company is building a 37,500 kVA, 3000 r.p.m. turbo-generator set for the Borough of Battersea, whilst extensions to the Birmingham Corporation power stations brought the firm orders for a 30,000 kVA, 3000 r.p.m. machine for the Nechells station and a 37,500 kVA, 1500 r.p.m. set for the Hams Hall station. The demand for back-pressure turbines for providing power and giving a supply of heat was, apparently, satisfactory, and a 10,000 kW, 3000 r.p.m. G.E.C. machine of this type was installed in a large paper mill in this country.

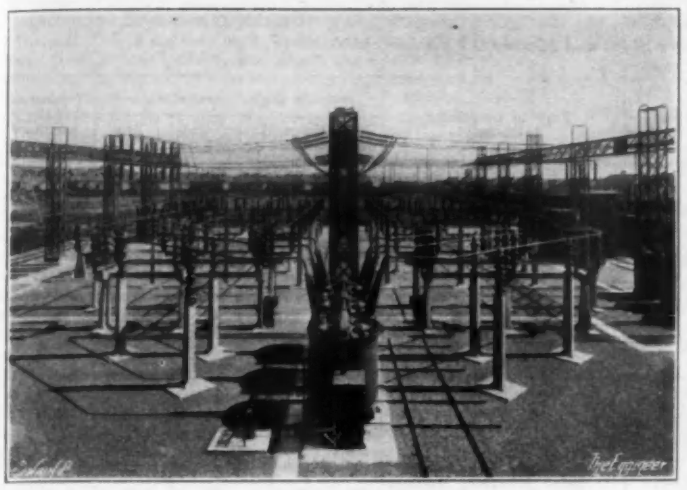


FIG. 4—BRIGHTON TRANSFORMING STATION

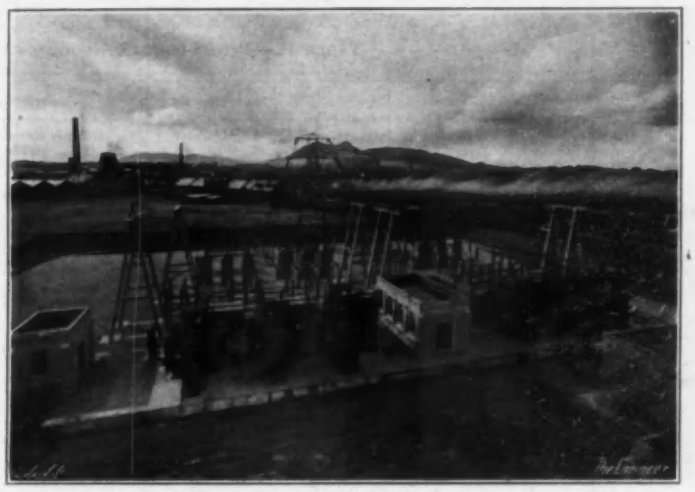


FIG. 5—PORTOBELLO TRANSFORMING STATION

fabricating the frames, shields, and base plates of electrical machines is now widely adopted at Rugby.

Two 24,000-kW turbo-alternator sets with condensers, and incorporating all the latest developments of C. A. Parsons and Co., Ltd., were completed and tested at the Heaton Works and are now in the course of erection in the Centrale Velsen power station of the Provinciaal Electriciteitsbedrijf Van Noord, Holland. In the factory the machines were tested under exceptionally interesting conditions, for they were run together in parallel at full voltage and current, the maximum output being 35,000 kVA. passes off at 35 lb. and 18 lb. per square inch respectively, the initial steam conditions being 365 lb. per square inch and 600 deg. Fah. During the year Parsons' turbo-generating plant was re-designed so that steel welded parts might be used as far as possible, and a new works was equipped with up-to-date machinery for dealing with the largest electrically welded parts, such as condenser bodies, alternator stator casings, bed-plates, transformer tanks, &c.

The English Electric Company installed 30,000-kilowatt, 3000 r.p.m. machines at West Ham—see An increase in the demand for geared turbines was also experienced by this firm, which supplied, among others, a geared pass-out turbine of 5000 kilowatts for paper mill service. The speed of the set is 6300 r.p.m., and it drives two generators in tandem at 500 r.p.m. The maximum amount of steam available for heating purposes is 60,000 at a pressure of 15 lb. per square inch. One of the largest oil engines built by the G.E.C. was a 1700 B.H.P., 300 r.p.m., six-cylinder engine driving a 6600-volt alternator for the Jaffa Electric Supply Company, of Palestine. Another unit—a five-cylinder 1350 B.H.P. engine

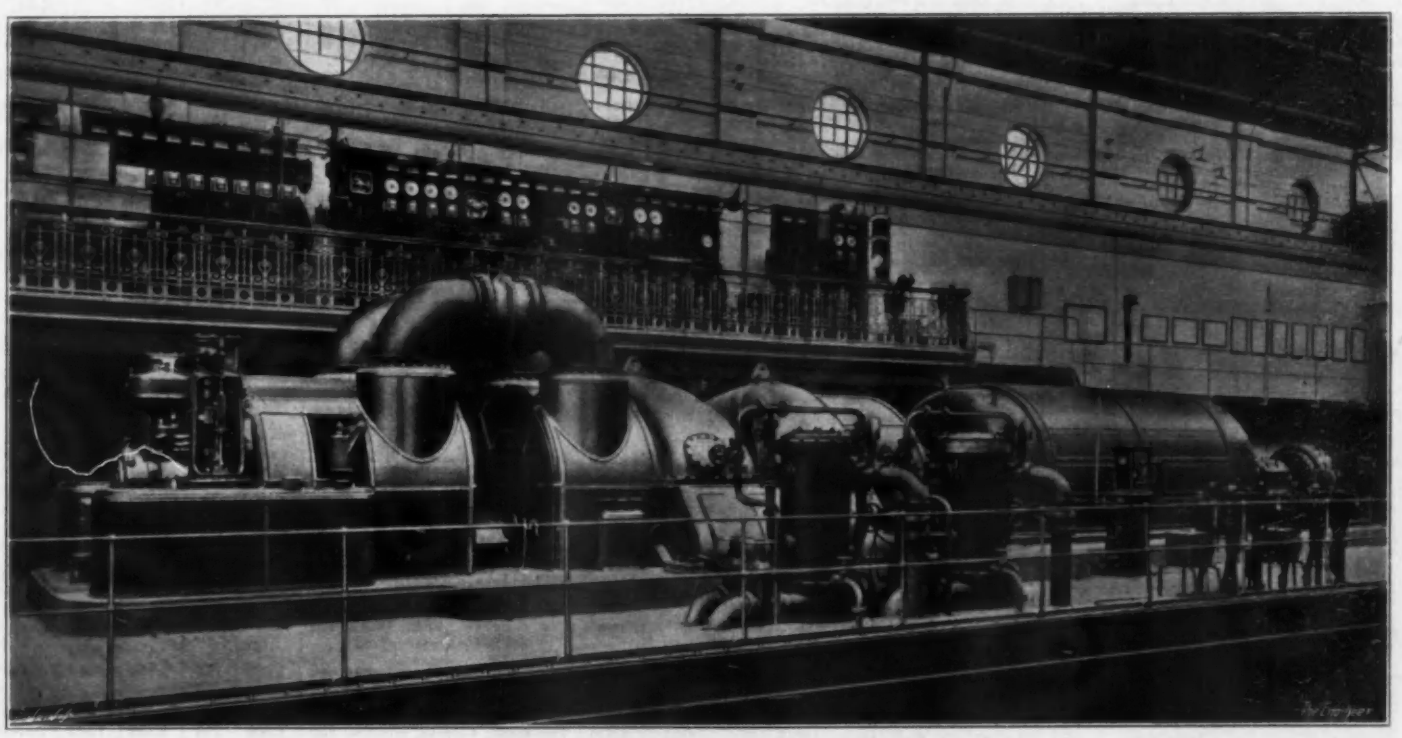


FIG. 6—30,000-kW TURBO-ALTERNATOR SET AT WEST HAM

That the 35,000-volt Parsons alternator in the Brimsdown station of the Metropolitan Power Company has proved satisfactory after over two years' operation is evident from the fact that the makers have received another order for a 25,000-kW machine for the same voltage. Three 50,000-kW turbo-generator sets, being built by C. A. Parsons and Co., Ltd., for the Dunston station of Newcastle-upon-Tyne Electric Supply Company, Ltd., are to operate at an initial pressure of 600 lb. per square inch at a temperature of 800 deg. Fah. In the high-pressure cylinder, which is of the pure reaction end-tightened type, the steam will be expanded down to approximately 130 lb. Fig. 6—and at Bradford. Improvements were made in the design of smaller non-basement units with self-contained condensers, and in the method of nozzle control. Two exceptionally large English Electric back-pressure units—10,000 kW—are being erected at the Yallourn briquetting plant of the Victoria State Electricity Commission. Of the water turbines completed by the company during the year, those for the Lochaber station of the North British Aluminium Company were, perhaps, the most notable, for these five 10,000 horse-power turbines, driving generators with an aggregate output of 100,000 ampères have received a large share of the driving a 950 kW alternator—was built for the Basingstoke Corporation.

The aggregate capacity of turbines manufactured wholly or partly in the Metropolitan-Vickers Electrical Company's works, amounting to over 600,000 kW, with approximately equivalent total capacities of condensers and turbo-alternators. Several large sets were completed during the year, or are now nearing completion in the factory. The largest is a 67,200 kW set for the Battersea Power Station of the London Power Company. This set, which is nearing completion, has a three-cylinder turbine unit and a single unit main alternator of 80,000 kVA capacity. A

BRITISH-BUILT MOTOR SHIPS AND MARINE OIL ENGINES, 1930

TABLE I.—*Motor Ships of 1000 Gross Tons and Upwards Fitted with Marine Oil Engines and Completed in Great Britain and Northern Ireland During the years 1920 and 1930 Inclusive.*

Year	1920.	1921.	1922.	1923.	1924.	1925.	1926.	1927.	1928.	1929.	1930.
Number of ships completed	7	15	17	14	43	44	30	40	73	55	108
Total gross tons	53,407	83,980	114,527	78,862	231,764	282,325	212,063	228,751	468,477	422,424	744,010
Total I.H.P.	31,140	42,860	69,820	49,137	145,130	180,125	160,460	174,905	305,960	336,290	529,460

TABLE II.—*British-built Passenger and Cargo Motor Ships and Marine Oil Engines*, 1930.

Owners.	Name of ship.	Speed and type.	Shipbuilder.	Hull particulars.				Type of propelling machinery.	Main engine particulars.					Number and kW size of auxiliary generator sets
				Length B.P.	Breadth m'lded.	Depth m'lded.	Gross tonnage		Cyl. bore.	Piston stroke.	R.p.m.	Total I.H.P.	Total S.H.P.	
				Feet.	Feet.	Feet.			mm. & in.	mm. & in.				
Argentine Navigation Co., Ltd.	Barcelona	Cargo ship	Harland and Wolff, Ltd.	278	43	13	1,496	Two 6-cyl., S.A., airless injection, trunk piston, Harland-B. & W.	15¾	29½	155	1,220	900	Steam and electric aux.
	Genova	"	" " "	278	43	13	1,496	" " "				1,220	900	
	Amberes		A. and J. Inglis, Ltd.	278	43	13	1,496	" " "				1,220	900	
	Hamburgo		" " "	278	43	13	1,496	" " "				1,220	900	
	Cuidad de Acuncion	Pass. & cargo	" " "	320	58·6	27	2,850	Three 6-cyl., S.A., 4-stroke, airless injection, trunk piston, Harland-B. & W.	400	750	223	3,170	2,600	
	Cuidad de Corrientes	"	" " "	320	58·6	27	2,850		400	750	223	3,170	2,600	
Bank Line, Ltd.	Iris Bank	13-knot cargo ship	Workman, Clark, Ltd.	425	57	38·5	5,883	Two 5-cyl., 2-stroke, S.A., Workman Clark-Sulzer	680	1,200	100	5,500	4,500	Oil - electric aux.
	Lossie Bank	"	" " "	425	57	38·5	5,883	" " "	680	1,200	100	5,500	4,500	
	Taybank	"	" " "	425	57	38·5	5,883	" " "	680	1,200	100	5,500	4,500	
	Tweedbank	"	" " "	425	57	38·5	5,883	" " "	680	1,200	100	5,500	4,500	
	Foylebank	"	Harland and Wolff, Ltd.	426·8	57·3	38·7	5,583	Two 8-cyl., 4-stroke, S.A., airless injection, Harland-B. & W.	590	1,200	100	5,600	4,600	Oil - electric aux.
	Laganbank	"	" " "	426·8	57·3	38·7	5,583	" " "	590	1,200	100	5,600	4,600	"
Bibby Line, Ltd.	Worcestershire	15-knot pass. & cargo	Fairfield Shipbuilding and Engineering Co., Ltd.	482	60	36·25	10,500	Two 8-cyl., 2-stroke, S.A., Fairfield-Sulzer	28	39	110	9,600	7,700	3, 110 kW
Blue Star Line, Ltd.	Tuscan Star	15-knot pass. & cargo	Palmers Shipbuilding and Iron Co., Ltd.	470	68	39·78	11,449	Two 8-cyl., 2-stroke, S.A., Sulzer	680	1,200	115	11,790	9,000	4, 350 kW
Canada Cement Transport Co.	Cementkarrier	Cargo	Furness Shipbuilding Co., Ltd.	258	43·3	20	1,971	Two Polar, 4-cyl., 2-stroke	340	570	214	1,000	770	
China Navigation Co., Ltd.	Anshun	Pass. & cargo	Scott's Shipbuilding and Engineering Co., Ltd.	350	60	33	3,200	One 6-cyl., 2-stroke, S.A., airless injection, Scott engine	27	45	112	3,600	3,000	3, 85 kW
City of Cork Steamship Co.	Innisfallen	18-knot pass. & cargo	Harland and Wolff, Ltd.	321	45·75	19·25	3,019	Two 10-cyl., 4-stroke, S.A., airless injection, Harland-B. & W.	630	980	160	7,500	6,000	2, 110 kW; 1, 220 kW
Elder, Dempster and Co., Ltd.	Edward Blyden	12½-knot cargo ship	Harland and Wolff, Ltd.	370	51·5	33·5	4,000	One 8-cyl., 4-stroke, S.A., airless injection, B. & W. Diesel engines	740	1,500	108	4,000	3,100	3, 65 kW
	Alfred Jones	"	" " "	370	51·5	33·5	4,000	" " "	740	1,500	108	4,000	3,100	3, 65 kW
	David Livingstone	"	A. McMillan and Son, Ltd.	370	51·5	33·5	4,022	" " "	740	1,500	108	4,000	3,100	3, 65 kW
	Mary Slessor	"	" " "	370	51·5	33·5	4,016	" " "	740	1,500	108	4,000	3,100	3, 65 kW
	William Wilberforce	"	D. and W. Henderson, Ltd	370	51·5	33·5	4,013	" " "	740	1,500	108	4,000	3,100	3, 65 kW
	MacGregor Laird	"	" " "	370	51·5	33·5	3,850	" " "	740	1,500	108	4,000	3,100	3, 65 kW
	Henry Stanley	"	Ardrossan Dockyard	370	51·5	33·5	4,028	" " "	740	1,500	108	4,000	3,100	3, 65 kW
	Mary Kingsley	"	" "	370	51·5	33·5	4,017	" " "	740	1,500	108	4,000	3,100	3, 65 kW
Holt and Co., Alfred	Maron	14½-knot cargo	Caledon Shipbuilding and Engineering Co., Ltd.	426	56	31·9	6,701	Two 6-cyl., 4-stroke, S.A., Büchi supercharged N.E.M. engines	620	1,300	138	6,700	5,500	4, 100 kW
	Clytoneus	"	Scott's Shipbuilding and Engineering Co., Ltd.	426	56	31·9	6,600	Ditto, Scott's engines	620	1,300	138	6,700	5,500	4, 100 kW
	Myrmidon	"	" " "	426	56	31·9	6,600	Ditto, Scott's engines	620	1,300	138	6,700	5,500	4, 100 kW
	Polyphemus	"	" " "	426	56	31·9	6,665	Ditto, Scott's engines	620	1,300	138	6,700	5,500	4, 100 kW
	Deucalion	16-knot cargo	Hawthorn, Leslie and Co., Ltd.	453	59	35·3	7,740	Two 8-cyl., 4-stroke, S.A., airless injection, B. & W., supercharged engines	740	1,500	110	10,600	8,600	3, 170 kW
Hvalfanger Rosshavet	Sir James Clark Ross	11-knot whale tanker	Furness Shipbuilding Co., Ltd.	550	74·3	28	14,362	Two 6-cyl., 4-stroke, S.A., airless injection, B. & W.	630	1,300	125	4,600	3,800	2, 100 kW
La Morue Française	President Houduce	10½-knot motor trawlers	Cox and Co., Ltd., Falmouth	213·25	34·5	19·12	1,150	One 7-cyl., 2-stroke, S.A., Polar, airless injection	340	570	214	1,026	770	2, 72 kW
	St. Martin Legasse	"	" " "				1,150	" " "	340	570	214	1,026	770	2, 72 kW
	Spitzberg	"	" " "				1,150	" " "	340	570	214	1,026	770	2, 72 kW
	Groeland	"	" " "				1,150	" " "	340	570	214	1,026	770	2, 72 kW
Nelson Lines, Ltd.	Highland Hope	16½-knot pass. & cargo	Harland and Wolff, Ltd.	523·4	69·4	37·15	14,129	Two 8-cyl., 4-stroke, D.A., Harland-B. & W.	680	1,000	95	9,600		4, 200 kW
	Highland Princess	"	" " "	523·4	69·4	37·15	14,129	" " "	680	1,000	95	9,600		4, 200 kW
Netherland Steamship Co., Ltd.	Talisse	Pass. & cargo	Caledon Shipbuilding and Engineering Co., Ltd.	465	62	36·3	8,230	One 8-cyl., 2-stroke, S.A., Sulzer	820	1,440	106	9,000	7,000	4, 200 kW
	Tanimbar	"	" " "	465	62	36·3	8,230	" " "	820	1,440	106	9,000	7,000	4, 200 kW
New Zealand Shipping Co., Ltd.	Otaio	15½-knot refrig. cargo	Vickers-Armstrongs, Ltd.	470	67	40	10,048	Two 2-stroke, opposed-piston, Doxford	700	Com'd 2,100	120	11,600	10,330	3, 306 kW; 1, 125 kW
Quebec and Ontario Transport Co.	Thorold	Paper carrier	Earles Shipbuilding Co., Ltd.	250	43·75	23	2,961	One 2-stroke, 4-cyl., S.A., Sulzer	470	820	150	1,250	1,000	3, 7½, 23 and 45 kW
Silverline, Ltd.	Silverwillow	14-knot cargo	J. L. Thompson and Sons	450	61·3	26·9	5,955	Two 4-cyl., 2-stroke, opposed-piston, Richardsons - Doxford	600	1,800	112	6,800	5,500	4, 100 kW
	Silveryew	"	" " "	450	61·3	26·9	5,955	" " "	600	1,800	112	6,800	5,500	4, 100 kW
	Silvercypress	"	Harland and Wolff, Ltd.	456·3	62	25·6	6,670	Two 6-cyl., 4-stroke, pressure charge, Harland-B. & W.	740	1,500	120	8,400	7,350	Oil - electric aux.
	Silverwalnut	"	" " "	456·3	62	25·6	6,670	" " "	740	1,500	120	8,400	7,350	Oil - electric aux.
	Silversandal	"	" " "	456·3	62	25·6	6,670	" " "	740	1,500	120	8,400	7,350	Oil - electric aux.
	Silverteak	"	" " "	456·3	62	25·6	6,670	" " "	740	1,500	120	8,400	7,350	Oil - electric aux.
Union Castle Line, Ltd.	Winchester Castle	16-knot pass. & cargo	Harland and Wolff, Ltd.	630	75	44·5	20,109	Two 8-cyl., 2-stroke, D.A., Harland-B. & W.	840	1,600	98	17,000	13,000	4, 350-kW
	Dunbar Castle	14½-knot pass. & cargo	" " "	470	61	35·25	10,002	Two 6-cyl., 4-stroke, S.A., Büchi pressure charged	740	1,500	105	8,000	6,300	3, 250-kW
Ulster Imperial Line	Ulster Prince	14½-knot pass. & cargo	" " "	346	46·25	15·2	3,756	Two 10-cyl., 4-stroke, S.A., trunk-piston airless-injection Harland-B. & W.	680	980	160	7,500	6,500	3, 110-kW
White Star Line	Britannic	15-knot pass. & cargo	" " "	683·5	82·4	31·1	26,943	Two 10-cyl., 4-stroke, D.A., Harland-B. & W.	840	1,600	102	23,000	20,000	4, 500-kW

51,250 kW set, with an alternator of 62,500 kVA, recently put into commission at the Portishead power station of the Bristol Corporation, established a new record as the largest set yet completed or installed in this country. Another set of approximately the same capacity, with an alternator of 71,500 kVA, is now being erected as the first generating unit in the new Clarence Dock Power Station of the Liverpool Corporation. Among the higher speed—3000 r.p.m. —sets, a 32,500 kW machine, with an alternator of 40,000 kVA capacity, was supplied to the Victoria Falls and Transvaal Power Company. This set is the largest yet manufactured in this country for operation at this speed.

Several important independent tests were carried out during the year upon plant made by the company. Of these the most notable were made upon the Barton Power Station equipment, including the 40,000 kW set recently installed. These tests, which are recorded with their results in an I.E.E. paper by Messrs. H. C. Lamb and H. L. Guy, have established that the Barton station, which is equipped entirely with Metropolitan-Vickers generating plant, has the highest engine-room efficiency among the leading power stations of the world.

A new and interesting development which has been introduced and standardised by the company for large turbo-alternators is a system of magneto-generator excitation for main exciter fields. The magneto-generator, which is driven from a turbine governor spindle, has permanent magnet poles of cobalt steel. For their initial magnetisation the poles are provided with a magnetising winding, which is not normally connected in circuit. The winding can also be used for later re-magnetising if required, but this is not ordinarily necessary. The system has the desirable feature of ensuring stability of the main exciter at all loads, being practically equivalent to separate excitation from a battery. Another important feature is that a considerable voltage margin over that required by the exciter field is provided. This is an advantage in cases where automatic voltage regulators are used, as it enables a high voltage to be immediately impressed on the main exciter field when the regulator contacts close, thus increasing the speed of response of the exciter. With regard to works testing of large alternators, an important and probably unique development has been made by the company in recent extensions to testing equipment. The new equipment includes two 22,000 kVA reactors of the iron core, oil-immersed and water-cooled type, and these, together with the previously existing motor generator sets of the testing department, constitute means of testing large alternators at wattless loads up to more than 60,000 kVA. The equipment has been used for tests on many large machines built by the company, including the alternators for Bristol and Monte Video.

(To be continued.)

Motor Ships and Marine Oil Engines in 1930.

No. I.

THE year which ended on December 31st, 1930, will, without doubt, prove to be one of outstanding importance in the history of the British motor ship and the development of the marine oil engine. When, eleven years ago, we began this record, the number of motor vessels constructed during the year in the shipyards of this country only amounted to seven, and they were practically all of one single type. Last year saw 108 motor ships completed in British yards, which total represents about half the motor vessels completed throughout the world. Among the ships that were finished there were several large liners, a series of fast passenger and cargo ships, and some special vessels, along with smaller craft. The main feature of the year was the very large number of oil and molasses-carrying tankers, which amounted to close upon half the total number of ships completed. The yearly returns given in Table I. show clearly the gradually increasing importance of motor shipbuilding. The same figures are also shown in graphical form in Fig. 1. It is hardly necessary to point out that the building of motor ships and marine oil engines was responsible for the busy state of many shipyards and engine works throughout the year; but in many cases there was a slight falling off in activity towards the end of the year. The orders for motor ships which were placed exceeded those for steam ships, both at home and abroad. With regard to the British position, it is satisfactory to reflect that during the past year further steps were taken to produce new engines of all-British design, while the impress of the British designer was further deepened on those designs which had their origin on the Continent, but have become associated with the names of British builders. On the technical side there was no new feature to record with regard to the use of larger cylinder diameters and piston strokes, but greatly increased outputs per cylinder were obtained by utilising the principle of pressure-charging, making use of the exhaust-gas, turbine-driven blower. Means for recovering and using the heat of the exhaust gases were also improved. In view of the large number of motor ships completed last year, it is not possible for us to give full details of all of them, as we have done in previous years; but in Table II. we have set out the principal passenger liners and cargo ships built in British yards during 1930, with particulars of their propelling engines and auxiliary generator sets. As may be gathered from the table, there was a further extension of the standardisation of both hulls and propelling machinery, which, in many cases, enabled the cost of production to be reduced, and our charged installation of oil engines yet constructed. The excellent results obtained under trial conditions have, we understand, been borne out in sea service, and now that the engines have been well run in, it is expected that even more economical results will be attained. The satisfaction which the owners feel with regard to this noteworthy British liner and her engines is, perhaps, best illustrated by the fact that they have decided to install the same type of engines in the sister liner, the "Georgic," which is now under construction at Belfast. Among other

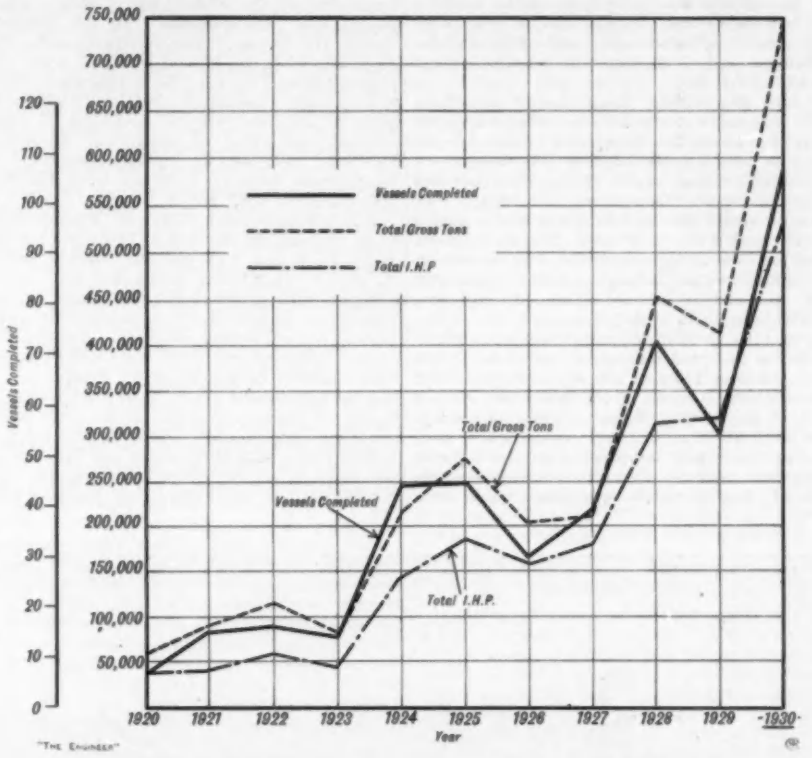


FIG. 1—MOTOR SHIP AND MARINE OIL ENGINE OUTPUTS, 1920-1930

competitive power increased, with the result that many orders for ships were obtained from abroad. This was especially so with regard to oil tankers for Norwegian owners and for American and continental oil interests.

The Motor Passenger Liner.

There was a remarkable increase in the number and variety of motor passenger liners built during 1930. Pride of place in this class of ship belongs to the 27,000-ton White Star liner "Britannic," a view of which is given in one of to-day's Supplements. She was built and engined by Harland and Wolff, Ltd., at Belfast, ran her trials in June last, and took up her regular service at the end of that month. Her principal particulars are given in Table II., and in our issue of June 27th we described her propelling — quadruple-screw, double-acting, four-stroke, 20,000 S.H.P.—machinery, which bears the distinction of being the most powerful unsupercharged installation of oil engines yet constructed. The excellent results obtained under trial conditions have, we understand, been borne out in sea service, and now that the engines have been well run in, it is expected that even more economical results will be attained. The satisfaction which the owners feel with regard to this noteworthy British liner and her engines is, perhaps, best illustrated by the fact that they have decided to install the same type of engines in the sister liner, the "Georgic," which is now under construction at Belfast. Among other important motor vessels built and engined by Harland and Wolff, Ltd., at their Belfast and Glasgow establishments were three large liners for the Union-Castle Mail Steamship Company, Ltd., two of which were completed. The "Dunbar Castle," a sister ship to the "Llangibby Castle," was built at Harland's Govan yard and ran her trials in May last. A full description of her will be found in THE ENGINEER of May 30th. She is a 10,000-ton liner and has twin-screw pressure-charged oil engines of the Harland-

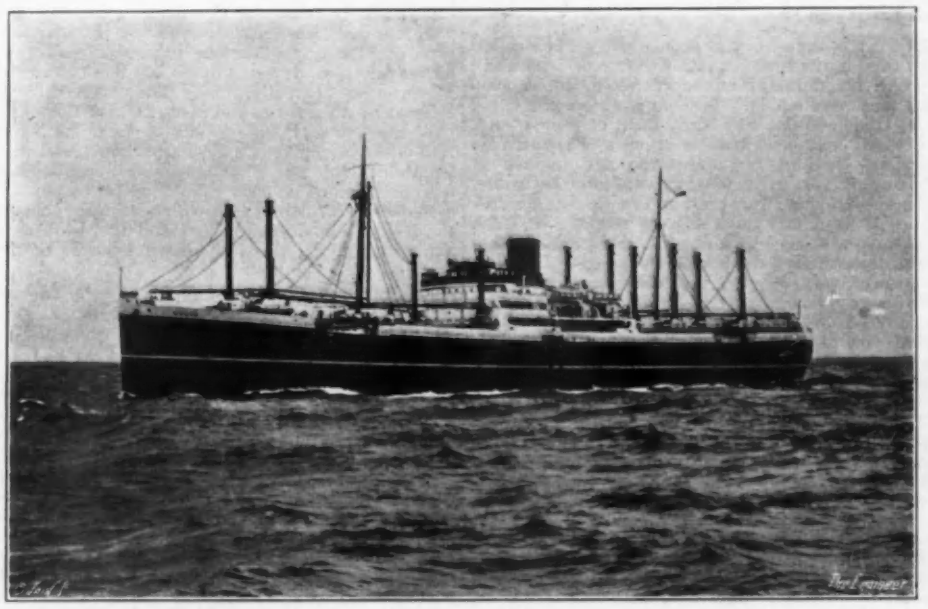


FIG. 2—NEW ZEALAND SHIPPING COMPANY'S MOTOR CARGO LINER "OTAIO"

B & W four-stroke, single-acting type. This liner has, we learn, given most economical results, with very smooth running, on her owners' intermediate service to South and East Africa.

Later in the year the 20,000-ton twin-screw motor liner "Winchester Castle," which was built and engined at Belfast, was added to the Union-Castle fleet. The sister ship, the "Warwick Castle," was also launched and good progress was made in her engining and fitting out. A full description of

the "Winchester Castle" was given in our issue of October 17th, and a view of her is included in to-day's Supplement.

Other motor liners built by Harland and Wolff included the two Nelson Line ships "Highland Hope" and "Highland Princess," which are modern refrigerated cargo carriers with up-to-date passenger accommodation. We regret to have to record that late in the autumn the "Highland Hope" ran aground during a fog on the rocky coast of Portugal, and suffered total loss, happily, however, without any serious casualties among either passengers or crew. Like her sisters she was very popular in service. They are all 14,000-ton ships, with a length of 523·4ft., propelled by twin-screw, eight-cylinder four-stroke, double-acting oil engines, with a designed total output of 10,000 S.H.P.

Among the outstanding large motor passenger liners built and engined abroad we have chosen for illustration in to-day's Supplement the largest motor liner of the French Line, or the Compagnie Général Transatlantique, which, during the year, was put into service on the Havre-New York route. She is a 25,000-ton vessel, having a length of 610ft., with a beam of 77ft. and a depth of 50ft. Accommodation is provided for over 1000 passengers. The propelling machinery comprises a quadruple-screw arrangement of M.A.N. two-stroke, double-acting, oil engines, two of which were built at Augsburg and two at the Chantiers et Ateliers de St. Nazaire Penhöet. These engines have a designed output of 16,000 to 18,000 S.H.P., at speeds of 145 and 150 r.p.m. respectively, which gives a service speed of 17½ knots and gave a trial speed of 18¼ knots. There are five oil-electric generator sets, three of 700 kW, two of 500 kW, and the deck machinery is operated on the Gilbert-Austin constant current system. With her single low tapered funnel and one-pole mast, the "Lafayette" is a ship of outstanding appearance, differing from other vessels of the French Line.

Some Fast Cargo Liners.

Among the cargo-carrying fleets which were extended in 1930 we may mention that of the Silver Line, Ltd., to which six standard motor vessels of about 6000 gross tons were added. Two ships were constructed by J. L. Thompson and Sons, Ltd., of Sunderland, and were equipped with twin-screw Richardsons-Westgarth-Doxford opposed-piston oil engines of 5500 total S.H.P., giving a service speed of 14½ knots. The other five ships were built and engined at Queen's Island, Belfast, and have a gross tonnage of 6770. They have a designed speed of 15 knots and the propelling machinery comprises twin-screw Harland-B. and W. motors with pressure charging on the exhaust gas turbine-driven blower principle, with waste heat recovery boilers. The cargo-carrying facilities are of a high order, and good accommodation for the officers and crew is a feature of the design. Another building programme which was carried through at the Belfast yards of Harland and Wolff, Ltd., and Workman, Clark (1928), Ltd., was that of the Bank Line, Ltd., managed by Andrew Weir and Co., which firm took delivery of six 13-knot cargo ships of about 9000 tons deadweight carrying capacity. Particulars of these vessels are given in Table II. In the four Workman-Clark-built ships five-cylinder twin-screw Workman-Clark-Sulzer motors were installed, while in the two Harland and Wolff-built ships there are twin-screw sets of eight-cylinder Harland-B. and W eight-cylinder airless-injection motors.

Important additions were made to the Blue Funnel Line fleet of Alfred Holt and Co. Four standard 14½-knot cargo ships were delivered, one of which—the "Maron"—was built by the Caledonian Shipbuilding Company, Ltd., Dundee, and the other three—the "Clytoneus," "Myrmidon," and "Polyphemus"—by Scott's Shipbuilding and Engineering Company, Ltd., Greenock. These 6400-ton ships are for the owners' Eastern trade, and besides up-to-date refrigerated and ordinary cargo spaces, arrangements are made to carry a limited number of passengers and a large number of pilgrims on certain sections of the voyage. The propelling machinery, two sets of which for the "Maron" were constructed by the North-Eastern Marine Engineering Company, Ltd., of Wallsend, and the other six sets by Scott's, is of the four-stroke single-acting six-cylinder type, working on the Büchi supercharging principle with air injection. With the exception of the supercharging device, the engines are of British design and are entirely free from any patents or monopoly devices which would prevent them from being constructed by other builders. The total designed output of the two sets of engines is 5500 S.H.P., corresponding to a ship's service speed of about 14½ knots. At the beginning of November the builders and owners placed the "Polyphemus" at the disposal of the Marine Oil Engine Trials Committee, and during two days following the official builders' trials very complete tests were made. The comparative figures which will be made available when these trials are published later in the year will no doubt be of considerable interest and value to designers. In our issue of February 28th last we published an account of the bench trials made by Professor C. J. Hawkes on the port engine of the "Maron."

Just before the end of the year Messrs. Holt and Co. took delivery of a further 16-knot 7740 gross ton cargo ship, the "Deucalion," which was built by R. and W. Hawthorn, Leslie and Co., Ltd., and was engined with Burmeister and Wain eight-cylinder twin-screw airless injection motors working on the Rateau supercharging principle. These engines have a total designed output of 8600 S.H.P. at 110 r.p.m. The omission of the blast air compressor makes a shorter engine and a very neat engine-room arrangement. A sister ship, the "Ajax," was launched by Scott's during the last weeks of December, and she will be fitted with Burmeister and Wain engines, but will have an engine-driven supercharger. The carrying through of this interesting building programme was made possible by the very thorough work of Mr. Sterry B. Freeman, the owners' superintendent engineer, and his technical staff. Another interesting ship completed by Scott's at Greenock at the end of the year was the "Anshun," in which was installed a new type of British single-acting two-stroke motor with airless injection, designed by Scott's Shipbuilding and Engineering Company, Ltd. The "Anshun" was ordered by John Swire and Sons, Ltd., of London, for the passenger and cargo service of the China Navigation Company. She is a 3200 gross ton vessel with a length of 350ft., and her single-screw engine has a designed output of 3000 B.H.P. at 110 r.p.m. The cylinders are 27in. diameter with a stroke of 45in., and the design embodies several new and interesting details while embodying the well-known features of Scott engines.

One of the most important cargo-carrying motor ships of the year was the "Otaio," shown in Fig. 2, which was built for the New Zealand Shipping Company's service from London to New Zealand *vid* the Panama Canal by Vickers-Armstrongs at Barrow-in-Furness. She is equipped with Doxford opposed-piston oil engines with a designed output of 9300 S.H.P. at 120 r.p.m., and her high power for a cargo-carrying vessel is noteworthy. The principal particulars of the "Otaio" are given in Table II. on page 8.

Another fleet which, during 1930, was greatly extended was that of the British and African Steam Navigation Company, Ltd., and the African Steam Ship Company, Ltd., both of which companies are managed by Elder, Dempster and Co., Ltd. The new ships are 12½-knot shelter-deck vessels, with a length of 370ft. and a beam of 51·5ft., the gross tonnage being on an average 4022 each. As will be seen from Table II., the hulls of these ships were constructed at four different Scottish yards, and all the ships were equipped with a single-screw eight-cylinder airless injection Harland-B. and W. motor having a designed output of 3100 S.H.P. at 110 r.p.m. Harland and Wolff also built some cargo and passenger vessels for the Argentine Navigation Company, Ltd., and supplied machinery for ships constructed for the same owners by A. and J. Inglis, Ltd., of Pointhouse, Glasgow.

In reviewing cargo ships built in 1930 it is necessary to refer to the very economical cargo ship "Amerika," which was built and engined by Burmeister and Wain, Ltd., of Copenhagen, for the Californian service of the East Asiatic Company. The "Amerika" made during last year three long voyages, one to Bangkok and two to Vancouver. Her double-acting two-stroke oil engines operated most satisfactorily with the low fuel consumption of 24 tons a day for 6000 S.H.P., corresponding to 160 grammes per B.H.P. hour, or about 0·352 lb. for the main engines only. A sister ship is approaching completion for the same owners, and a set of the new type of double-acting engines is to be installed in Alfred Holt's cargo ship the "Stentor" in the present year.

A further addition to the Bibby Line fleet of motor ships, was made by the finishing of the "Worcestershire," which was built and engined by the Fairfield Shipbuilding and Engineering Company, Ltd. This ship is in all respects a sister vessel of the "Staffordshire," and we give particulars of her in Table II.

The completion of the Blue Star Line twin-screw motor ship "Tuscan Star" was an important event, as that ship is the first motor vessel in the Blue Star Line fleet. She was built by Palmer's Shipbuilding and Iron Company, Ltd., at Hebburn-on-Tyne, which also installed in her twin-screw, eight-cylinder Sulzer two-stroke, single-acting engines, which were built at Winterthur. The designed output of these engines is 9000 S.H.P. and the service speed of the ship 15 knots. The "Tuscan Star" is noteworthy on account of her extensive refrigerated cargo equipment and because of her electrical arrangements which are most complete.

In Table II. we also give particulars of two cargo ships, built by the Caledonian Shipbuilding and Engineering Company, Ltd., of Dundee, for the Netherlands Steamship Company, of Amsterdam, which were fitted with Sulzer propelling engines installed by the builders. At the same yard the cargo ships "Skotaas" and "Fosna" were launched for the Aktiebolagat "Götaverken," of Sweden, and will be towed to Gothenburg to receive their Swedish-built engines.

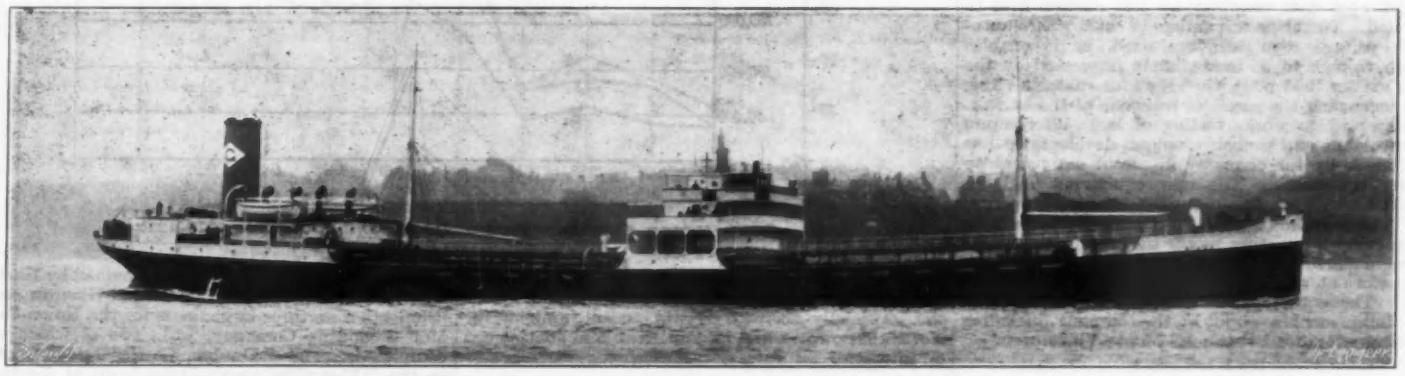


FIG. 3—STANDARD ARMSTRONG, WHITWORTH OIL TANKER "BISCA"

Cross-Channel and Other Special Motor Ships.

With the delivery of the "Ulster Prince" from Belfast early in the year, the Belfast Steam Ship Company, Ltd., completed its fleet of three fast cross-channel motor ships for traffic between Belfast and Liverpool. Those who have travelled on these well-appointed ships will appreciate the excellent way in which the firm of Harland and Wolff, Ltd., have solved the problem of the fast cross-channel motor vessel. A similar ship, but with slightly less passenger accommodation and larger provision for cattle transport, is the "City of Cork," also completed at Belfast, for the Fishguard-Cork service of the Cork Steamship Company. She is an 18-knot ship with a length of 320ft. and is propelled by twin-screw, airless-injection Harland-B. & W. motors of 6000 S.H.P. total output. A new 19½-knot ship was laid down in 1930 for the Newcastle-Bergen service of the Bergenske Shipping Company. She is being built by the Elsinore Shipbuilding Company, of Denmark, and will be engined by Burmeister and Wain. The engines are to be supercharged and will be designed for a service speed of 19½ knots, making the voyage between the two ports in 21 hours.

An interesting motor ship, which we illustrate in to-day's Supplement, is the whaling parent ship and factory, "Sir James Clark Ross," which was launched in April last from the Haverton Hill yard of the Furness Shipbuilding Company Ltd., and completed to the order of the Hvalfanger Rosshavet, of Sandefjord, Norway. The ship was constructed under the supervision of Messrs. Arnesen Christensen and Smith, of Newcastle-upon-Tyne, and the propelling machinery was supplied by Burmeister and Wain. She is designed to carry over 20,000 tons of whale oil, and is built on the Isherwood brackетless system. A complete factory for dealing with whale carcases forms part of the equipment, and there is accommodation on board for a crew and staff of 225 persons. The principal particulars of this unusual vessel are given in Table II. Another vessel of somewhat original design was completed by the Furness Ship-

building Company, Ltd. We refer to the cement-transporting ship "Cementkarrier." She is the fourth of her type built at Haverton Hill for Canadian owners, and incorporates the latest devices for the bulk carriage of cement and its automatic discharge. The cargo is carried in three self-trimming hopper type holds, with centre line bulkheads, which deliver into two fore and aft scraper tunnels. There is a high-speed Fuller-Kenyon cement pump and Reavell compressed air discharging arrangement. The main propelling machinery was supplied by the Atlas Diesel Company, of Stockholm, and most of the electrical equipment was furnished by the General Electric Company, of London and Witton. The same type of propelling machinery, namely, Polar engines of the Atlas Diesel Company's manufacture, was installed in four motor trawlers which were built at the Falmouth yard of Cox and Co. (Engineers), Ltd., for La Morue Française. The propelling machinery is placed right aft and there is an auxiliary electrical installation with a Clarkson composite oil-fired waste heat boiler, which supplies heating steam to the accommodation spaces. An illustrated description of this particular boiler was given in our issue of March 21st last. Another special motor ship is the paper carrier "Thorold," built by Earles Shipbuilding and Engineering Company, Ltd., of Hull, for service on the Great Lakes of America. She was fully described and illustrated in our issue of July 18th.

Motor Tanker Construction in 1930.

The most remarkable feature of motor ship construction in 1930 was the large number of tankers completed and launched and the placing of several very important tanker orders. Early in the year, the Anglo-Persian Oil Company, Ltd., placed orders for six 10,000-ton D.W. tankers, three of which will be built on the Clyde, and will be engined by J. G. Kincaid and Co., Ltd., with Harland-Kincaid engines, and three on the North-East Coast, with Doxford opposed-piston motors. These ships will, however, not be delivered for some months. The Anglo-Saxon Petroleum Company also placed orders in Great Britain and on the Continent for twenty new 11,500-ton D.W. tankers, with supercharged Werkspoor engines, eleven of which will be built on the Clyde and the Tyne and at Belfast. British builders were not successful in gaining orders for nine Standard Oil Company 16,000-ton tankers, which went to Germany and Italy. In Fig. 3 we illustrate the "Bisca," one of ten standard 8970 D.W. tankers constructed by Sir W. G. Armstrong, Whitworth and Co., Ltd., for Norwegian owners, all of which are propelled by standard six-cylinder Armstrong-Sulzer motors of 2250 S.H.P. designed output. The same builders also delivered an 11,000 D.W. tanker, also for Norway. At Wallsend-on-Tyne, Swan, Hunter and Wigham Richardson, Ltd., built and engined several standard tankers, mostly for Scandinavian owners, and machinery of the Wallsend-Sulzer standard type was utilised. At Hebburn-on-Tyne, Palmers Shipbuilding and Iron Company, Ltd., built two tankers for A. E. Moss and Co., and two for the Anglo-American Oil Company, Ltd. The latter ships are propelled by Doxford opposed-piston engines, and a special feature is the provision of an overhead water spray to cool the surfaces of the oil tanks and so reduce evaporation. On the Clyde several standard tankers were built for British and foreign owners by Barclay, Curle and Co., Ltd., Barclay-Doxford motors being installed, while at the Blythswood Shipbuilding Company's yard three standard tankers were finished and were engined by Kincaid.

Robert Doxford and Son, Ltd., built and engined a series of standard oil tankers for Norwegian owners. The single-screw, 11½-knot, 415ft., 9634 D.W. tanker "Beth," is an example of these ships. They are propelled by a 3100 I.H.P. Doxford opposed-piston engine placed aft. Machinery was also supplied for other tankers, which were built at the yards of Sir Jas. Laing, Ltd., and J. L. Thompson, Ltd. At Palmers and the Furness Shipbuilding Company, Ltd., tankers were constructed for American owners. Seven molasses tankers were constructed by James Lithgow and Co., Ltd.; Robert Duncan and Co., Ltd.; Wm. Hamilton and Co., Ltd.; The Furness Shipbuilding Company, Ltd., and Cammell Laird and Co., Ltd., for the United Molasses Company, Ltd., and in them Kincaid-Harland and N.E.M. engines were installed. At Belfast, Workman, Clark and Co. (1928), Ltd., completed two tankers with Workman-Clark-Sulzer engines. The total number of motor tankers completed amounted to about half the number of motor ships built in Great Britain during 1930.

An interesting Clyde-built tanker is the "Winkler," which was constructed by Scotts Shipbuilding and Engineering Company, Ltd., for the Atlantic Oil Shipping Company, of Philadelphia. The propelling machinery comprises four Carels-Ingersoll-Rand engines, driving 600 kW B.T.H. generators at 250 r.p.m., along with 75 kW auxiliary generators. The main motor is a double-armature, 2800 S.H.P. machine, with a designed speed of 95 r.p.m. The "Winkler" carried out successful trials under the supervision of the owners' consulting engineer, Mr. Lester M. Goldsmith.

(To be continued.)

Aeronautics in 1930.

No. I.

THE history of the past twelve months is so overshadowed by disaster in the practice of flight that it must seem to many ridiculous, almost, in fact, sacrilegious, to talk about the progress of aeronautics during 1930. Some apology certainly appears to be required for associating the word with a branch of applied science which, after existing as a practical force for over twenty years, produces, among many others, a disaster as appalling and unexpected as that which befell the airship "R 101" or a catastrophe as complete and inexplicable as that which occurred to the Junkers monoplane at Meopham. In the one case there was involved a vessel on the design and construction of which neither time nor money had been stinted, and concerning the safety of which there was, in the light of experience reinforced by much research and calculation, no cause for anxiety. In the other case, the machine embodied the knowledge accumulated over many years, contained no feature at variance with well-tried and established principles, and was in the charge of a pilot possessing exceptional skill. Yet this airship and this aeroplane met with disaster, suddenly and for reasons which so far remain unexplained. After a quarter of a century of high scientific endeavour and a grievous sacrifice of life, is it rational to talk of progress when our best efforts are still at times thwarted so tragically, and, it would almost seem, so causelessly?

This question is one which must have arisen in the minds of many people during the past year. So far as the airship is concerned, the facts scarcely permit of any doubt as to the answer. It cannot be denied that structurally—that is to say, from the engineering as distinct from the operational point of view—the developments in airship building since the beginning of the century have been continuous and great. Airships are, or can be, now built with elaborate dining, sleeping and other accommodation for numerous passengers, they can be constructed to carry a formidable armament of guns, they may be provided with facilities for taking up aeroplanes and launching them when in flight, they may employ hydrogen or helium for their inflation and petrol, heavy oil, or "blau-gas" for fuel, they can be built of stainless or other qualities of steel instead of relying solely on aluminium alloys, and they may even be successfully constructed entirely of metal to the complete exclusion of fabric and goldbeater's skin. But while we may admire and applaud the skill and ability represented by these developments, we must not regard them as providing us with a definite and final means of assessing the progress of the airship. The only true criterion is the history of airships in the air.

We need not repeat the list of disasters which have befallen airships the world over, since they were first built. Let us look at the present rather than at the past. France and Italy have abandoned their former considerable interest in airships. In this country, work carried out on airships since the Armistice has represented an expenditure of £2,790,000. The vessels concerned are seven in number, namely, the R 33, 36, 37, 38, 80, 100, and 101. Two of these vessels met with tragic disaster in the air. One was begun and abandoned before completion. Others were dismantled after a brief flying life. The "R 100" alone survives. She has to her credit a double flight across the Atlantic, a flight which, as we now know, was accomplished not without anxiety and which, so far as performance was concerned, barely surpassed the similar flight of the "R 34" in 1919. The vessel is now in her shed awaiting a pronouncement of her fate. In Germany a single airship, the "Graf Zeppelin," is in active commission. So far, she has performed well, but has more than once escaped imminent disaster. Another airship, the "L Z 128," is being built at Friedrichshafen, but following the "R 101" disaster it was announced that her design was to be radically modified. In the United States, as in Germany, only one vessel of any size—the ex-Zeppelin "Los Angeles"—is in service. Two 6¾ million cubic foot helium-filled ships are approaching completion at Akron. Omitting small vessels, which are little more than toys, a quarter of a century's effort, all over the world, to build airships has resulted in the existence to-day of three vessels that have flown, and of three which have yet to fly. The rest, the numerous rest, have been destroyed or dismantled. Faith rather than reason is required to detect in these facts the existence or promise of progress.

The airship is as liable as ever to be struck down and reduced in a few moments to a mass of meaningless wreckage. The accident at Meopham in July was not the only one of the year to remind us that the aeroplane is still open to a similar fate. The circumstances of that disaster endow it, however, with special significance. The machine, of a well-tried type and piloted by a man of unsurpassed ability, was seen to fly into a cloud. It emerged dismembered, its parts and its passengers being scattered over a wide area. Careful inquiry and research have so far failed to reveal the cause of its destruction. Is it rational to talk of progress while such things can happen? We think it is. Once the time was ripe, man very quickly learned how to fly. A much harder task was to learn how to fly safely. He is still far from having mastered the second problem, but there is ample evidence to show that he is making progress with his studies. Quite apart from any evidence based on a knowledge of the structural improvements effected within recent years by the designers and builders of aeroplanes, statistics prove that flight in heavier-than-air machines is becoming safer. There was a time when the chances that an aeroplane flight would end without disaster were little more than even. To-day, in spite of the bad accident record of 1930, it can be asserted with confidence that the chances of success are vastly greater than those of failure. If at times the toll of accidents seems to imply that progress is stationary or painfully slow, we must balance our judgment on the subject with the reflection that the number of people who fly or make use of aeroplanes to-day is growing very rapidly, that they are not as they once were, entirely engaged in flying as their main occupation, and that the machines which they use are capable of a performance of an order which is becoming higher and higher each year. To judge this question of progress properly we would require to compare the number of accidents which happened in the earlier years of flying with those which would occur to-day if the old-time pilots, all of them specialists, could return and fly modern machines to the same extent as they flew the machines of their own days.

The year's record was a bad one, not only as regarded accidents in civil flying, but as regarded accidents to military machines. In the Royal Air Force the fatalities were almost exactly at the rate of one every six days. It is a grievous figure to record, but as evidence of progress or the lack of it, it is open to too many unconnected influences to provide a sound criterion. Safety is not the sole consideration in military machines. Their prime duty is to be in constant readiness to convey danger to an enemy. It is to be feared that the two requirements will never be found compatible even in peace time.

The British Aeronautical Industry.

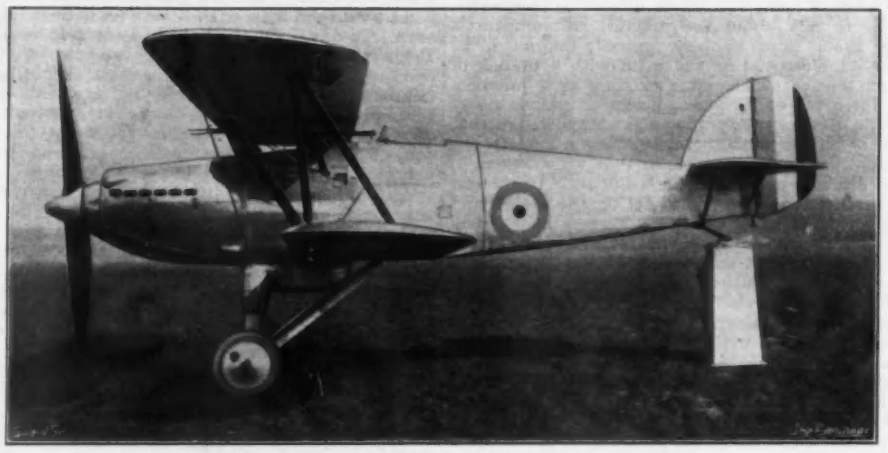
In spite of the general depression of trade, the British aeronautical industry maintained a satisfactory degree of activity during the year. The number of firms engaged in it was diminished by the withdrawal from it of William Beardmore and Co., Ltd., but this loss was more than compensated numerically by the arrival of one or two new firms. The explanation of the relatively good position which the industry maintained throughout the twelve months is to be sought in three facts: the extensive programme of re-equipment now being carried out by the Royal Air Force, the large increase in the popular interest in private flying, and a noteworthy development of the demand for British machines, service and civil, in foreign countries. It is undoubtedly true that the application of the knowledge gained by our designers and constructors in the production of the Schneider Trophy machines of 1929 and the prestige which has come to this country following the successful outcome of the contest have reacted greatly in favour of British machines abroad. For that reason all interested in the industry will welcome the possibility that the Air Ministry may after all not implement its previously announced intention of leaving this year's entry entirely in private hands. The fact that the Trophy, if we again win it, would pass permanently into our possession lends much added force to the very reasonable demand that the Air Ministry should do everything in its power to secure success for this country in the contest this autumn.

A general idea of the activities of the British aeronautical industry will be obtained by some brief references to the work and products of certain of the firms engaged in it.

Handley Page, Ltd.—The construction and successful initial flights of the large forty-seater aeroplane for Imperial Airways, Ltd., which will be found illustrated in one of our Supplements, formed the outstanding achievement during the year of Handley Page, Ltd. This machine is driven by four engines, two upper and two lower, the arrangement of which is such that the pilot can exercise complete control over the machine with any one of the engines idle. In our engraving the lower wings appear to run into the cabin somewhere near the middle of its height. Actually the wing roots slope upwards and join the cabin at the top. The cabin is, in fact, swung beneath the wings. As a result the passengers can enter the cabin without using steps, their view through the windows is uninterrupted, and, so it is claimed, liability to air sickness is alleviated. The actual portion of the cabin in line with the engines and wings is devoted to the luggage space, lavatories, and buffet. The passengers are carried in two compartments, each holding twenty people, one forward and one aft of this space for luggage, &c. In the nose of the body is a wireless room, and at the extreme end a cockpit for two pilots for whom dual control is provided. From the nose to the rear end of the passengers' quarters the cabin is formed with a metal skin in order to eliminate one of the several sources of noise in an aeroplane, the flapping of the fabric on the walls. Beyond the passengers' quarters the body is covered with fabric. A noteworthy feature of the wing design is the elimination of all external wire bracing, strut bracing being employed as in the firm's latest types

of military aircraft. The machine has a paying load of 8160 lb. and is designed to have a cruising speed of 105 m.p.h. at 1000ft.

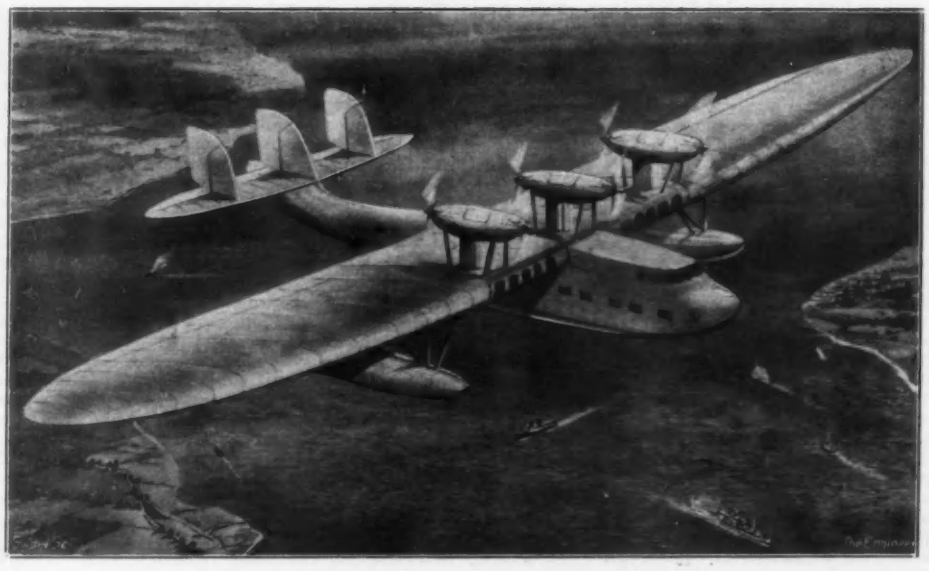
Among other work undertaken by the firm during the year was the execution of large orders for twin-engined Hinaidi night bombers for the Air Ministry and the development from that machine of the "Clive," a high-performance aeroplane which can quickly be converted from a bomber to a troop carrier, an ambulance machine, or a freight carrier. The "Hare" day bomber was produced with Armstrong-Siddeley "Panther" engines and was developed as a coastal defence torpedo carrier.



HAWKER "FURY" INTERCEPTOR FIGHTER

The Handley Page slot continued to make good progress during the year. The only unslotted machines in the Royal Air Force to-day are the single-seater fighters. It has now been decided to equip them with slots. The intercepted slot is the latest development. It consists of a small plate normally hidden in a recess in the wing, parallel with and close to the front spar. When the aileron of one wing is pulled up, link mechanism causes the interceptor plate to rise vertically and deflect upwards the air flow through the slot, which flow would normally pass over the plane. As a result the whole effect of the slot is destroyed. Official tests indicate that the intercepted slot permits of exceedingly quick changes in direction being made and enables the pilot to retain control when the machine is in an abnormal position. At stalling incidence the ordinary aileron is very ineffective as a means of rolling the aeroplane. In addition, it introduces a moment, which yaws the machine in the direction of the downward aileron. The interceptor introduces a rolling moment of the same sign as that given by the aileron and a yawing moment of the opposite sign.

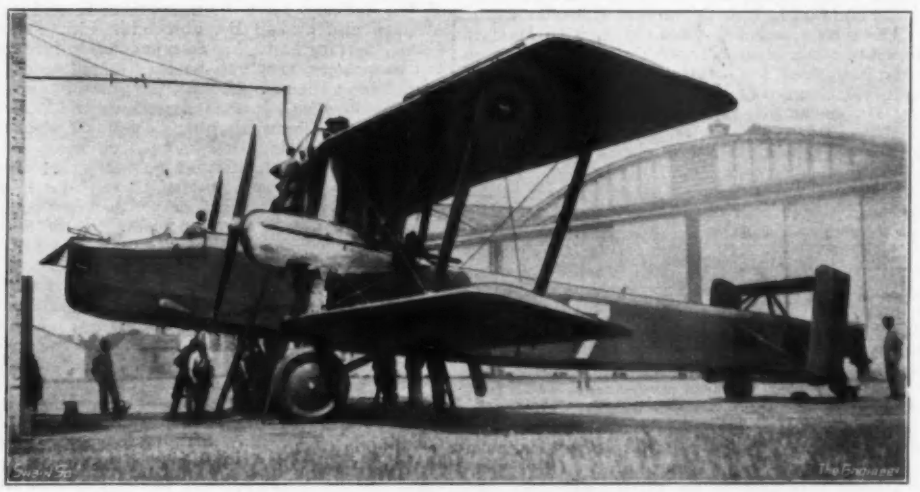
The Blackburn Aeroplane and Motor Co., Ltd.—The Blackburn "Sydney" three-engined reconnaissance flying-boat, illustrated in one of our Supplements, is stated to be the largest military monoplane flying-boat in this country. It was completed during the year and may be described as a monoplane version of the Blackburn Company's "Iris" three-engined biplane flying-boat. It is constructed entirely of metal, except for the fabric covering of the wing and of the tail. The hull has almost perpendicular sides, giving much more room in the inside than do the inwardly sloping sides of the "Iris's" hull. At the stern, a tail-defence machine-gun station is provided behind the tail plane. A steel tubular structure is built up on top of the hull to support the wing, additional wing support being derived from two pairs of sloping struts springing from the hull sides. These struts are bisected by others descending from the wing spars and carrying the wing floats. The engines are three Rolls-Royce F XII. M.S. of 525 H.P. each. They are carried in nacelles faired into the leading edge of the wing. Each nacelle contains a water tank and radiator, an oil tank and an oil cooler. The main petrol tanks are carried inside the faired structure supporting the wing from the hull. Normally, the machine carries a crew of five. Machine gunning, bombing, towing and mooring operations are attended to by the pilot-navigator in the forward cockpit. From it he can readily pass into the completely enclosed control cabin, where he can sit beside the pilot. The cabin top is fitted with sliding side windows and sliding panels in the roof. A water-tight bulkhead with a door at its centre extends across the hull interior behind the control cabin. Aft of this bulkhead, on the port side, is a navigating station, and on the starboard side the wireless station. Farther aft are two berths, lockers and cupboards, the engineer's station, and additional sleeping accommodation, with three folding bunks. Still farther aft come a lavatory, a cooking stove, an ice chest, and fresh water and paraffin storage tanks. Then comes the after gunner's cockpit, from which communication can be gained with the tail defence station at the extreme end of the hull. Data regarding the "Sydney" are not available, but it may be said that the machine weighs nearly 10 tons and is expected to have a top speed of over 120 miles per hour.



SUPERMARINE 40-SEATER SIX-ENGINED MONOPLANE FLYING BOAT

The H. G. Hawker Engineering Company, Ltd.—The machines produced by the Hawker Company have usually to be several years old before any description of them is permitted, and by that time they have become quite outclassed by the firm's later productions. Of the Hawker "Fury" interceptor fighter, illustrated on this page, we can say very little except that it is driven by a Rolls-Royce F.S. engine. This machine is a development of the firm's "Hart" high-speed day bomber, and has been selected as the standard interceptor fighter for the R.A.F., some squadrons of which are now being re-equipped with it. It has been adapted for Fleet air arm work, in which form it can be operated from a battleship or aeroplane carrier. The Hawker "Horsley," with Rolls-Royce "Condor III." engine, remains the standard high-altitude day bomber in the R.A.F. It has been modified for coastal defence work and as a torpedo bomber, can then carry a torpedo weighing 2150 lb., stated to be the largest ever handled by a land machine.

The Supermarine Aviation Works, Ltd.—A development of the well-known "Southampton" type of twin-engined metal constructed flying boat was produced at the Supermarine Works of Vickers (Aviation), Ltd. This machine, known as the "Southampton" Mark X., is illustrated in our Supplement. It is a service craft and was constructed to the order of the Air Ministry. The engine equipment consists of three Armstrong Siddeley Jaguar or Panther engines, mounted in monocoque nacelles, which also contain the oil tanks. The main fuel tanks are situated in the top centre section of the wings, from which the feed is effected by gravity. Provision is made for changing the engines while the machine is afloat. The boat hull is built of a duralumin framework, with the underwater plating in stainless steel. All the hull fittings are made of the same quality of steel. The wings are of "all-metal" construction, the upper one having a fabric covering and the lower one, because of its exposure to the splashing of the waves, having a covering of metal. The hull provides accommodation for a Lewis gunner forward, two pilots seated side by side, and a wireless operator and navigator inside the hull. Aft of the planes are two staggered gun rings, while behind the elevator there is a fourth gun station. Bunks for all the crew are provided inside the hull. The machine has a span of 79ft., a length of 55ft. 6in., and a height of 22ft. 6in.



VICKERS B 19/27 TWIN-ENGINED NIGHT BOMBER

On the civil side the works received from the Air Ministry an order for a very large six-engined monoplane flying boat, the design of which will be gathered from the accompanying reproduction of an artist's drawing. The construction of this machine has been begun, but it may be 18 months, or two years, before the craft is ready for service. The machine will be driven by six 900 H.P. Rolls-Royce H engines, mounted in three tandem pairs on the top of the wings. Accommodation within the hull and inside the wings will be provided for 40 passengers, and detachable bunks will be arranged in order that 20 passengers may sleep on the machine. The crew's operating quarters will be totally enclosed. Stainless steel will be used for the construction of the hull,

for the main spar structure of the wing, and for the nose covering of the wing. The rest of the wing covering will, we gather, be of fabric. The machine will have a span of 174ft., an overall length of 107ft. and an overall height of 32ft. Tanks to carry 2250 gallons of petrol will be provided. The anticipated maximum speed at sea level is 145 m.p.h., the normal range 700 miles, and the maximum range 1300 miles.

Vickers (Aviation), Ltd.—At the Weybridge works, "Vimy" and "Virginia" machines were reconditioned, and "Victoria" and "Vespa" machines were the subjects of fresh contracts for the Royal Air Force, the Bolivian Air Force, and the Army Air Corps of the Irish Free State. Experimental work was carried out on the "Vildebeest," a two-seater torpedo aircraft fitted with a Jupiter XI. F engine.

VICKERS "VELLORE" TWIN-ENGINED FREIGHT CARRIER

Another experimental machine to receive attention was that known as the Vickers B 19/27, a designation which marks the abandonment of names for experimental types. This machine, a development of the "Virginia," appeared in public for the first time at the R.A.F. Display of 1930, and is illustrated on page 12. It is a four-seater, twin-tractor biplane, designed for night bombing duties. The structure is "all-metal," chiefly duralumin, with fabric wing coverings. Handley Page slots are fitted on the upper wings and the balanced ailerons are of the Frise pattern. The under-carriage is fitted with hydraulically operated steerable brakes. The engines are two Rolls-Royce F XIV. S supercharged motors developing 480 H.P. each, and maintaining that output up to a height of 11,500ft. On the commercial side the company concentrated its attention on two types, the "Vellore" freight carrier, and the "Viastra" passenger carrier. The original "Vellore" was a single-engined machine of all-metal construction, which proved very successful for the carriage of goods. In its most recent form it is being produced as a two and a three-engined machine. We illustrate the twin-engined version on this page. As in the earlier design, the freight is loaded into the machine through a large trap door in the underside of the body. The engines are two Bristol "Jupiters." In the unladen condition the machine weighs 7435 lb. Its paying load is 3730 lb. It will be seen, therefore, that the machine retains the high ratio of paying load to net weight which was such a remarkable characteristic of the earlier design. The company, in conjunction with the Supermarine Works, is now preparing to adapt the "Vellore" as a twin-float seaplane. The "Viastra" is a high-wing monoplane, designed to carry twelve passengers. It is being planned to take either one, two or three engines. Two examples are under test, one fitted with two "Jupiter" engines and one with two "Jaguar" engines. The "Jupiter" version has a net weight of 7662 lb. and a paying load of 2770 lb. These figures may be compared with the corresponding figures for the "Vellore." They indicate the considerable sacrifice, nearly a thousand pounds, which has to be made in the paying load of a passenger machine as compared with a freight carrier.

A. V. Roe and Co., Ltd.—The activities of A. V. Roe and Co., Ltd., were centred on the design and production of two new types of training machine, a surveying machine, a six-seater, three-engined commercial monoplane, and the well-known Avian sports machine. The Avro 504 machine was first produced in 1913. It has been modified in several respects since then, but it still remains the standard training machine in many of the world's air forces. The new Avro trainer 621 is designed to replace the old and well-tried type. We illustrate it herewith. It is of "all-metal" construction, and is driven ordinarily by a "Mongoose" 155 H.P. engine, or by a "Lynx" 215 H.P. engine for advanced training. The wings are of equal span and are given a considerable stagger. The second-named fact not only provides the instructor and the pupil with a good overhead view, but facilitates the egress of the occupant of the front seat when wearing a parachute. The cockpits are identical in size and equipment and full dual control of the joy-stick and rudder-bar type is provided. The undercarriage is of very wide track and is without a transverse axle, a fact which facilitates landing on rough ground or long grass. The shock absorbers are of the oleo type, supplemented by rubber in compression. They are designed to protect the machine from damage caused by repeated bad landings without concealing from a pupil the error which he has made. The fuselage is a rigid unit of welded tubular steel, which is not only strong, but requires very little attention and can easily be repaired in the event of damage. Adjacent to the cockpits the wooden side fairings, in the form of panels, can be removed to expose beneath them the engine and other controls.

AVRO 621 ALL-METAL TRAINING AEROPLANE

The second type of new training machine is the Avro Applied trainer 626. This machine is similar to the new 621, but is equipped normally with a Lynx 215 H.P. engine. The feature of the machine lies in the fact that it can be adapted for eight different forms of training, the change from one form to another being effected in a few hours. It can, in this way, be used alternatively for instruction in bombing, Vickers gun operation, Lewis gun operation, radio communication, photography, night flying, navigation and dual control flying. The Avro Surveying Machine 623 is an adaptation of the 626 trainer for photographic surveying work. The Avro six-seater, three-engined monoplane is a slightly larger version of the firm's five-seater machine, exhibited at Olympia in July, 1929, and described in our columns at the time.

Hydro-Electric Engineering in 1930.

Two important hydro-electric undertakings—both of them in Scotland—were put into operation during the year. They were the Lochaber and the Grampian power plants, and views of the pipe lines in each case are reproduced in one of our Supplements. The Lochaber works, which form the first portion of a scheme which will eventually have a capacity of 120,000 H.P., are of interest for several reasons. In the first place, they include a tunnel some 15 miles long and about 15ft. in effective diameter, which was bored from end to end in solid rock. Then, too, the inlet to the tunnel had to be blasted into Loch Treig, a hundred feet or so below the surface. Then, again, the waters of eleven streams flowing down the northern faces of the northernmost slopes of the Ben Nevis range have been diverted by means of dams and led down through shafts into the tunnel. The points chosen for the diversions are in all cases at such an elevation that, should the flow of the streams be in excess, for the time being, of the requirements of the power-house, the water, instead of flowing to waste, may back up into Loch Treig and be stored. Another interesting point is that the two pipe lines at present in position, which are of lap-welded steel and of the spigot and faucet type, had all their joints electrically welded inside and out. It is noteworthy that, when tested, not a single "weep" showed itself. These works, which are intended solely for the production of aluminium, were carried out on behalf of the Lochaber Water Power Company by the North British Aluminium Company, Ltd., which latter is a subsidiary company of the British Aluminium Company, Ltd. The engineers to the scheme are Messrs. C. S. Meik and Halcrow, of Westminster, and the contractors Balfour, Beatty and Co., Ltd. The works were described in our issues of April 25th, May 2nd, and 9th, 1930.

The Grampian Works, on the other hand, are designed for the distribution of electricity. They are being carried out by the Grampian Electricity Supply Company, Ltd., the engineers and contractors being Balfour, Beatty and Co., Ltd., with Mr. W. T. Halcrow, of Westminster, acting as advising civil engineer. The works, which were put into operation towards the end of the year, and which, as in the case of the Lochaber works, only form the first portion of a much larger scheme, involved (*a*) the construction of a concrete dam 1360ft. long and 57ft. high at the southern end of Loch Ericht; (*b*) the piercing of two tunnels of a combined length of 14,470ft. and 12ft. 4in. diameter, lined, these tunnels being connected together where the aqueduct has to be taken across the river Ericht, by means of a circular riveted steel pipe; (*c*) the laying of two riveted steel pressure pipe lines, 8ft. in diameter and 2700ft. long; (*d*) the building and equipping of a power-house which has an initial capacity of 32,000 kW in two units; (*e*) the erection of an outdoor sub-station with transformers for stepping up the generated voltage of 11,000 to 132,000, for linking up with the "grid," and to 33,000 for the company's own distribution system; and (*f*) the running of two sets of transmission lines for those higher voltages. The average available head is 490ft. The linking up with the "grid" was effected most successfully, a peak load demand of some 15,000 kW being experienced on the first day, and the plant is, we understand, giving great satisfaction. We hope shortly to be able to describe this interesting undertaking in detail.

The Perak River hydro-electric power scheme was completed during the year and the plant brought into operation. We published particulars of the scheme in our issues of August 22nd and 29th and September 5th. It is designed to furnish electrical energy to the tin mines in the valley of the Kinta River, Federated Malay States, which valley runs parallel with that of the Perak River. The works consist of a dam and power-house at Chenderoh and a steam power station at Malim Nawar, about 45 miles south of the hydro-electric station. At Chenderoh the power-house contains three Francis turbines, each coupled to a 9000-kW generator. The normal head available at the dam is from 50ft. to 60ft. The steam power station contains three turbo-alternators, each of 6000 kW capacity. The fuel used is a local lignite. A view of the Chenderoh dam, taken in June, 1930, when it was nearing completion, is reproduced in one of our Supplements. For the greater portion of its length the dam is a hollow reinforced concrete structure of the Ambursen type.

Letters to the Editor.

(We do not hold ourselves responsible for the opinions of our correspondents.)

IRON AND STEEL IN JAPAN.

SIR,—In your issue of October 31st last, under "Miscellanea," you said that "the iron industry of Japan is always threatened by the cheap pig iron from India, which is sold below the cost of the home product, &c."

This is untrue, both in essence and in fact, and is simply a re-echo of the propaganda of the syndicated pig iron makers of Japan.

The Indian pig iron exports to Japan are those of the well-known makes "Burn" and "Bengal," and, to a much lesser extent, "Tata," and the price at which these high quality products are sold is considerably higher than that which the Japanese makers accept for an admittedly much inferior product.

The position with regard to pig iron in Japan is of considerable interest, as it shows the manner in which the Japanese makers are co-operating and the support they secure from their Government in their endeavours to kill the competition.

The following statistics are extracted from the Government Mining Department Publication, just issued :—

Pig Iron Produced in or Imported into Japan (in Tons).

	1925.	1926.	1927.	1928.	1929.
China	47,822	3,796	5,849	30,748	56,836
United Kingdom	8,185	7,595	6,727	8,397	9,134
Germany	711	—	2,266	6,568	4,896
U.S.A.	86	102	102	27,766	30,474
British India ..	153,332	227,628	261,130	310,489	411,477
Sweden	2,958	238	2,197	1,695	814
Others	103,265	160,281	194,676	185,533	140,424
Japanese production	696,720	821,832	912,183	1,109,627	1,113,463

NOTE.—"Others" is the Manchurian (Anshan) shipment and excludes the Penhsihu iron, which seems to be included under China. The statistics are somewhat confused, as at times Manchurian supplies are considered home production and at other times as "foreign," as in this instance.

It will be noted that if the Indian supplies have risen from 150,000 tons in 1925 to 400,000 tons in 1929, the home production has risen from nearly 700,000 tons to over 1,100,000 tons in the same period.

The majority of the Japanese pig iron works were established during the time of the World War and merely to take advantage of the then existing conditions, and at that time any and every possible type of plant was purchased at high prices without regard to its economical production. To-day most of the works are in difficulties, and, to save themselves, have now become syndicated, and under the plea of patriotism, the campaign to use home products being pushed to its utmost, the makers have demanded from the Government, and are likely to succeed in obtaining their demands, as follows :—

(1) An increase of the duty from the present yen 1·70 to yen 7·00 per ton.

(2) The continuation of the bounty they receive as follows : Yen 3·00 per ton, where pig iron is manufactured and sold to outside works for casting purposes, &c.; yen 5·00 per ton where pig iron is produced and sold to other works for conversion to steel; yen 6·00 per ton where pig iron is produced and converted in the same works to steel.

(3) The amalgamation of all the pig iron works with the Imperial Government works or the taking over by the private works of the Government works.

It should also be noticed that the pig iron industry in Japan is free from income and business profit taxes.

The present duty and bounty alone amount to 20 per cent. protection on the selling price. It has been clearly shown that the proposed increased duty and the other schemes are uneconomical and that the shutting out of the imported supplies of pig iron can only be made good by a correspondingly much greater import of iron ore, manganese, &c., coking coal and scrap, as the Japanese works are almost entirely dependent on such imported supplies; but this does not deter the Japanese Pig Iron Syndicate in its demands and in its aim to obtain a monopoly in the market when consumers would be squeezed without mercy.

In order to secure the monopoly of the steel makers' requirements, the syndicate agreed to accept a much lower price than that current, and, in fact, arranged to accept a price for their pig iron equal to approximately $^{6}/_{10}$ths of the current price for steel bars. In view of the world situation the price of steel bars in Japan should be about yen 55·00 per ton, but the Imperial Government works, which fixes the nominal price, dare not publish such a figure, but gives yen 65·00 as the correct price. At any rate, the Japanese pig iron makers have run their quotations down to yen 33·00 per ton, whereas the nominal quotation and that which the Indian makers have been trying to maintain is yen 53·00, or more.

It is true that the Japanese makers have claimed that they have been forced to reduce their prices on account of the Indian competition, but, as just stated, this is untrue and, as stated at the beginning, the price for the Indian product is higher than that of the Japanese pig iron, but the Indian supplies are of a much higher grade and, generally, much preferred by every class of consumer in consequence.

The Japanese syndicated makers have also caused an inquiry to be made as to whether or not the Indian suppliers are guilty of "dumping," as Section V. 2 of the Japanese Customs Tariff Law provides for heavy penalties against "dumping."

Against this the Indian suppliers have shown that there is no grounds for the claim that they are "dumping," or that the Indian supplies are being sold at unreasonably low figures. The Indian makers claim that their price should not be based on the small local demand, but be considered as being based on the rich iron ore supplies they enjoy, the cheap supplies of suitable and ample coking coal, cheap labour, rationalised methods of production and marketing, &c.

The Indian works were established for export purposes—85 to 90 per cent. of the production being exported—but, in any case, prices in Japan are higher than charged for exports to China, United States of America, and Europe for the same class of goods and about the same as charged for the small local outlet.

In their efforts to secure a monopoly in the market, the Japanese makers are using any and every means to kill competition. They have recently opposed the use of imported steel pipes—some 6000 tons—in order to secure the use of Japanese cast iron pipes—some 24,000 tons—even though this will mean an increased expense of some yen 680,000 for the proposed water works scheme in question, and at a time when all other industrialists are seeking to curtail production the pig iron makers in Japan alone are seeking to increase their output and to choke out of existence all competition quite regardless of true economy.

Finally, the position has great importance for British trade, whilst, at the same time, the pig iron makers in Japan are, or soon will be, practically dependent on British supplies for their raw materials and notably iron ore, as this item will in future only be obtainable from Australia and the F.M.S., as the Chinese supplies are to be stopped.

The value of the Indian imports for 1929 was no less than yen 17,049,686, and against your statement that Indian imports in 1930 will be 250,000 tons, I am of the opinion that the total will not be much over 150,000 tons, owing to the action of the Japanese makers.

If the Japanese syndicate succeeds in killing the British trade, it will be a sorry day, not only for the Indian makers, but also for the Japanese public, the only persons who will benefit being the Japanese pig iron makers, who are selfishly pursuing their own ends and who totally disregard the true welfare of their own country and its people.

IRONMAN.

Kobe, December 6th.

Yen 1·00 value, approximately 2s. 0¼d.

Section V. 2 of the Japanese Customs Tariff Law reads as follows :—

"When important industries in Japan are threatened by the importation of unreasonably cheap articles or the sale of imported articles at unreasonably low prices, the Government may, under the regulations provided by Imperial Ordinance, specify such articles, after submitting the matter to the investigation by the Unreasonably Cheap Sale Investigation Committee, and impose upon them during a certain fixed period of time duties not exceeding in amount their proper prices, in addition to the duties provided for in the annexed tariff.

"In case the articles specified under the provisions of the foregoing paragraph have been already imported and are in the possession of an unreasonably cheap seller or his agent, the additional duties may be collected from such seller or his agent according to the provisions of the preceding paragraph.

"The collection of such duties shall be conducted according to the regulations governing the collection of national taxes."

THE "ROCKET."

SIR,—I have not seen the correspondence in the *English Mechanic* to which Mr. Holeroft refers. At the same time, viz., 1884–5, there was a discussion in THE ENGINEER, in which the same story of a second "Rocket" was brought forward; but, after consideration, I dismissed it as a myth.

But there is this about it: if true, it would explain the title "Rocket" on Nasmyth's drawing—see my "Centenary History of the L. and M.R.," pages 81 and 82. My attention has just been drawn to another version of this drawing, which is in the Newcastle-on-Tyne Art Gallery. It may be merely a copy by another hand of the original by Nasmyth, which was reproduced in THE ENGINEER for September 12th, 1884, as the note in the right-hand lower corner is worded quite differently.

Steyning, December 22nd. C. F. DENDY MARSHALL.

SIXTY YEARS AGO.

IN our issue of January 6th, 1871, we devoted eleven columns to a review of the progress of engineering in the year that had just closed. The task, formidable even then, was simple compared with that of which the results are before the reader in to-day's issue. It was still possible in those days for one man to survey with considerable intimacy of knowledge all the great branches of the profession. Railways, tunnels, bridges, canals, harbours, waterworks, sewage disposal, gas supply, road construction, steam engines, locomotives, naval and military engineering, and the electric telegraph; these were the subjects which fell within our field of review in 1871. It is a goodly field truly for one individual to cover. To-day, each of the sections has become subdivided and specialised, and great new branches—electrical engineering, the internal combustion engine, and aeronautics, in particular—have been added. Of the year 1870 we wrote that during its first half there had been manifest a spirit of returning confidence in the investment of capital in engineering undertakings. The country had not wholly recovered from the financial panic of two or three years back, but its vast supplies of locked-up capital were again being released, and the engineer, after a very lean period, was again beginning to find a field for his services. Then, at a moment's notice, the picture was suddenly changed. The Emperor of the French declared war against Prussia. It was the death-blow to many a sound enterprise, and the immediate ruin of certain established branches of trade and manufacture. The war still raged. It was devastating France and half ruining Germany. But we reminded our readers that it would not last for ever, and that when it was ended this country would be in a position to supply both the belligerent countries with the capital and equipment required to repair the damage that had been done. There was, we wrote, no risk in the future, except that which might be incurred by the prolongation of the war until both sides were exhausted, or until France submitted sullenly to terms, the bare mention of which would stir the pulses of her people with a desire to be avenged on those who imprudently dictated them. It was a long-sighted anticipation of the terms which Bismarck eventually imposed on his conquered foe. We foresaw the risk, but could scarcely have anticipated that it would not be dispelled until forty-seven years had passed.

South African Engineering Notes.

New Ford Factory.

THE new Ford factory at Port Elizabeth was completed in October at a cost of £60,000 and is in operation. The factory proper covers an area of 72,000 square feet and is divided into various departments, such as machine shops, carpenters' shop for building trucks and van bodies, battery-charging department, enamelling room and ovens, lacquer rooms with paint booths, where large ventilators carry away the fumes, body-building line, trim line, and the final assembly line. A craneway 65ft. wide extends the full length of the building, and contains double tracks, one for ingoing material and one for outgoing finished cars or trucks. An electric travelling crane, capable of lifting 5 tons, runs the full length of the building. The railway tracks extend 500ft. outside the building at the rear, and there are a loading platform, luncheon room, and paint storage building, blacksmith shop and a 30,000 gallon water tank 60ft. high and connected up with the sprinkler system, with which all the buildings are equipped. The combined area of buildings and ground is slightly over 9 acres. The factory is designed to turn out 12,000 cars and trucks per year.

Overhauling Whalers.

During the past winter no less than 28 whalers from the Antarctic have been repaired and overhauled at Durban to the satisfaction of their owners—mostly Norwegian firms. At Cape Town at least 38 were similarly dealt with, but Durban has certain advantages which may result in its becoming the chief port in Southern Seas for the refitting of these vessels. Durban possesses one of the largest dry docks in the world and also a very large floating dock. During the close season, while the whalers were being repaired, an experiment was tried in the docking of these vessels, and proved very successful. The whalers were placed in the dry dock side by side and under this arrangement it is possible to put six in the inner portion of the dry dock and eight in the outer dock part, making fourteen in all, while three were placed in the floating dock. The average time the whalers are in dock is three weeks, so that in a season of five months, approximately 100 whalers could be dealt with, provided, of course, that the space is not required for any other craft. The estimate given by Thesen and Co., which is connected with the Antarctic whalers, gives the sum of £100,000 as having been expended in Durban by the Antarctic whaling fleets which called there during this last off season. Of that amount about £80,000 was spent on engineering repairs. During the last whaling season the whaling fleets' catches amounted in value to about £10,000,000. This year, with even larger fleets and the more general use of expedients for killing the animals, the sum is expected to be larger.

Johannesburg Gasworks.

The new British gas-making plant installed at Johannesburg has given complete satisfaction, and is capable of producing more than the specified 1,500,000 cubic feet per day. The quantity of gas made during the year ended June last was 171,587,700 cubic feet, an increase of 34,750,000 cubic feet over the previous year. Ten years ago the production was 23,875,200 cubic feet. Mains laid last year totalled 17·85 miles. By-products produced amounted to 5250 tons of coke and 185,138 gallons of tar and oil. The year's revenue was £65,383, and working expenses £44,477, while capital charges absorbed £18,387, leaving a net surplus of £2517, or 3·74d. per 1000 cubic feet sold. Consumers number 925, as against 623 when the works started on December 23rd, 1928.

OBITUARY.

JOHN PETTIE MacTAGGART.

THE death of Mr. J. P. MacTaggart, who was for many years manager of the Cardiff Branch Office of the English Electric Company, Ltd., is announced as having taken place on December 16th. Mr. MacTaggart was born in Edinburgh in 1875, and was the third son of William MacTaggart, the artist. He was educated and served his apprenticeship in his native city, and joined Siemens Bros. and Co., of Woolwich, in 1896. From there he went to the Newcastle office of the company, and after a short time was appointed manager of the Cardiff office.

Railway and Road Matters.

WHEN the London, Midland and Scottish scheme for the enlargement of the docks at Fleetwood, referred to in this column on December 5th, comes under consideration, an understanding of it is to be assisted by a model that will cost £1600.

THE Brighton Corporation is depositing a Brighton, Hove and District Transport Bill, which is to establish a joint transport board, representative of Brighton, Hove and Messrs. Tilling. Brighton surrenders its tramways, Messrs. Tillings their omnibuses and Hove makes a cash contribution.

THE new terminus in Bombay of the Bombay, Baroda and Central India Railway was opened on December 18th by Sir Frederick Sykes, the Governor of Bombay, who, by the way, is a former director of the London Underground group. It is built on 53 acres of land, a good deal of which was reclaimed under the Back Bay development scheme.

ANSWERING a question on December 17th, the Minister of Transport announced that by agreement between the railway companies, the Mining Association and the National Federation of Iron and Steel Manufacturers, the railway companies, in approved cases, will carry out the improvements necessary at collieries and private sidings to permit the use of 20-ton wagons. Government grants, under the Development (Loan Guarantees and Grants) Act, 1929, will be available and the traders will make repayment within a period of 15 years, with interest at 5½ per cent.

WE are very glad to be able to record that well-merited promotion has come to Captain H. P. M. Beames, of Crewe, as a consequence of Mr. E. J. H. Lemon having been made chief mechanical engineer, London, Midland and Scottish Railway. On the death of Mr. Bowen Cooke in 1920, Captain Beames was appointed chief mechanical engineer, London and North-Western Railway, and when that company became one of the constituents of the L.M.S. system, was made mechanical engineer (Crewe). He is now removed to Derby as deputy chief mechanical engineer.

FROM Norwood Junction Station there is a curve, 50 chains in length, which joins, at Spur Junction, the Crystal Palace–Beckenham Junction line. This short connection was closed during the war, and has not, along with the remainder of the lines in the vicinity, been converted to electric traction nor reopened. The local public authorities are pressing the Southern Railway to reopen the line, as it will enable passengers between Bromley and stations in the Brighton direction to join their trains at Norwood Junction or Croydon instead of having to go to Victoria.

AT the recent annual dinner of the staff of the general manager and secretary of the Southern Railway, Sir Herbert Walker spoke of the interests of railways in road transport, and, as a result of powers obtained in 1929, in the air business. As a consequence of the latter, the Southern Railway has "taken a big interest in Imperial Airways, and that will enable us to have a say in their policy." In concluding his remarks, Sir Herbert observed: "Railways already have a monopoly of the steamship services to the Continent, and are going to control, in the course of time I hope, the whole of the transport system of this country. That is what we are aiming at and what we are going to achieve."

SOME very interesting information as to the life of Pullman cars was given by Mr. Follett Holt, the chairman and managing director of the Pullman Car Company, at its recent annual meeting. That company owns 235 cars, most of which are of entirely modern design. A very few, although still giving useful service, are over the age, and will disappear within the next few years. Meanwhile, their extended life serves to bring the average age of all the stock up to ten years. Whilst an ideal basis is to take an average life as one of twenty-five years, there is little doubt that the cars of the Pullman Company, maintained and re-formed as they are from time to time to suit changing requirements, should certainly average thirty years, which means that each car has still a probable life of twenty years.

THE recent Christmas holidays have seen the anniversary of a far more serious accident than that at Leeds on December 21st, 1880, mentioned in this column on December 26th. We refer to that, also on the Midland Railway, on December 24th, 1910, at Hawes Junction, which, again, was noteworthy because of the results which followed. The summit of the Settle and Carlisle is at Ais Gill, where most of the pilot engines that have assisted up trains from Carlisle and down trains from Skipton or Hellifield, are detached. There is, however, no engine turntable at Ais Gill, and the engines have to proceed to Hawes Junction to turn. On the morning in question there were, among the engines that had turned and were waiting for a road to return light, two for Carlisle. They stood at the down starting signal, but were overlooked, and the midnight express from St. Pancras ran into them. There was considerable telescoping, and a fire broke out in the wreckage. Twelve passengers were killed. Among the benefits that resulted from this serious disaster were the introduction of the shock-absorbing buffer as a preventative against telescoping; safety valves for gas cylinders; and the strengthening of the headstock of carriages—the last was a point that had already been raised in the Willesden collision of the 5th of the same month. Besides improvements in rolling stock design, there were two important developments in railway signalling. One was the adoption of a form of lock-and-block, which was a noteworthy step for the Midland Company, as it had been the strongest opponent to the use of that safety appliance. But the most important was the recognition by that company and other British railways of the benefits of track circuit. As related in a leading article on Railway Accidents in THE ENGINEER of October 31st, that safeguard has been the main reason for the reduction in the number of passenger train collisions from 184, 233, 217, and 172 respectively for each five-year period from 1901 to 1920 to 107 for the five years ended 1929.

Notes and Memoranda.

PLANS are now being prepared for the new sub-stations required for the Osaka Municipal Rapid Transport Railway in Japan. About ten large sub-stations are to be erected and work on the construction of those at Umeda, Shinsaibashi and Tennoji will be started early in 1931. Tenders for the necessary equipment will be invited about next April.

THE B.B.C. has announced that the site of the Scottish regional transmitting station has been chosen at Westerglen, 3 miles south of Falkirk, in Stirlingshire. The work of building the station is being put in hand immediately, the design being similar to that adopted for the London and North regional stations. The new station will be the third twin transmitter to be built as part of the Corporation's regional scheme, and will, when in operation, replace the existing low-power transmitters at Glasgow, Edinburgh and Dundee.

A SUMMARY of our present knowledge of tantalum, as well as of its sister metal niobium, which has only commercially come into notice lately, is given in the monograph of the Imperial Institute, "Tantalum and Niobium," which will shortly be published by H.M. Stationery Office. In this monograph, which deals naturally mainly with tantalum on account of the greater amount of information available about it, general information is given about the metals themselves as well as of their ores, and the production, properties, and uses of tantalum. The greater part of the book is devoted to descriptions of the more important occurrences of tantalum and niobium minerals, both British and foreign.

AT the recent Convention of the American Institute of Steel Construction, the President stated, according to the *Iron and Coal Trades Review*, that the Chrysler building in New York was the first to use alloy steel to any extent in its exterior walls, and that the Empire Trust State Building would have an even greater proportion. The next step in building construction would be all-metal walls for skyscraper construction as being cheaper, as well as more lasting and more efficient than masonry. Discussing future housing, Mr. Charles F. Abbot, executive director of the Institute, asserted that a "practical, durable and economic steel residence is shortly to be realised." Complete cottages will be made in factories and merchandised in much the same way as are automobiles.

FOR the purposes of the construction of the regulating dam on the Mattawin River, in Canada, of the Shawinigan Water and Power Company, the sand pit was formed near the saw mill at Cenelles Rapid. The ground level there was, says the *Contract Record*, only a very few feet above the river, and sand was excavated by a grab to a depth of 20ft. under water. During the winter, when the temperature averaged 25 deg. below zero for long periods and reached a minimum of 45 deg. below, the water in the sand pit was heated from the saw mill. At night the fire had to be kept up in the saw mill anyway, and the available steam was utilised for this purpose. This heat cost nothing, as it was produced by the combustion of waste material. The hot pond enabled the sand to arrive in the bins in a warm condition, even in the most extreme weather. Both the sand and stone bins were heated by steam pipes from a wood-burning boiler.

IN order to maintain comfortable temperature and cleanliness in railway cars during the summer, when travel is often attended with discomfort due to heat, dust, and smoke, both the Baltimore and Ohio Railroad and the Atchison, Topeka and Santa Fe Railway are, according to the *Engineering News-Record*, experimenting with an air-conditioning system which cools and cleans the air supply. Each railway has a dining car thus equipped. Air drawn from the interior of the car and supplemented by outside air is passed through filters and cooling coils, and then distributed through ducts to openings along the sides of the monitor roofs. The car windows are kept closed and the doors are opened only as persons pass in and out. The apparatus is under the control of the car conductor or steward and is able to deal promptly with special conditions, such as the entrance of smoke when passing through tunnels. In a hot-weather test on the Baltimore and Ohio the interior temperature of 93 deg. was reduced to 70 deg. in twenty minutes after the apparatus had been put into service. On the Santa Fe, tests showed that with an atmospheric temperature of 104 deg. in the deserts, the interior of the car could be maintained at about 70 deg. In both cases the cooking stoves were in full operation.

AT a recent meeting in Brighton, when Mr. Ambrose Gorham, the squire of Telscombe, provided a luncheon, an important stage in the development of electricity supply in the Brighton rural area was celebrated. The supply was first afforded to Telscombe Cliffs from the Brighton Corporation electricity undertaking on October 27th last. In view of the building development which is likely to take place within the next few years, the possibilities of a ring main from the Portobello sub-station around the east and north boundaries of the Brighton area have been investigated. In the first instance, this main will be operated at the existing pressure of 8000 volts, but provision has been made for the voltage to be increased to one of the standard intermediate pressures at a later date. The total length of the new ring main will be 8 miles, 0·1 square inch, and the first section of it has just been completed, consisting of 1100 yards of underground cable from Portobello sub-station to Telscombe Tye, and a mile of overhead line from which a spur line has been taken to the little village of Telscombe, where a 30 kVA Crompton Parkinson outdoor transformer sub-station has been provided, and to which the supply was first commenced on December 14th. This little area is, perhaps, unique, as there are only 17 houses and cottages, of which 13 were available to take the supply when it was first switched on, excluding sundry farm buildings which are not wired. It is interesting to observe that electric cooking has been adopted under some very interesting conditions. Three small cottages belonging to farm employees are each equipped with a cookerette and an electric kettle, in the larger houses electric cookers are also included, whilst in the largest house a refrigerator and electric fires are already quite popular.

Miscellanea.

IT is proposed to construct a bridge 1800ft. long across the Whangpoo, near Shanghai.

THE exhibition of the British Chemical Plant Manufacturers' Association is to be held in the Central Hall, Westminster, from July 13th to 18th.

IT is said that a rich strike of gold has been discovered in the Luano Valley, Northern Rhodesia. The site is to the west of Broken Hill, where coal was recently found.

THE District Board of South Arcot, Madras, has sanctioned a sum of Rs. 2,07,000 for the construction of a bridge over the river Vellar on the road to Chidambaram.

IT is expected that the new low-temperature carbonisation retorts of the South Metropolitan Gas Company, at East Greenwich, will be producing on a commercial scale during the present month.

THE erection of a silk mill in Port Moody, Vancouver suburb, is contemplated in the near future by the Western Canada Silks, Ltd., of Vancouver. The plant, it is reported, will cost approximately 250,000 dollars, and employ 100 persons. Raw material will be imported from Japan and China.

THE Canada Cement Company, Ltd., with head offices in Montreal and plants at various points throughout Canada, proposes to erect an additional unit to the present plant on the outskirts of Port Colborne in the town of Humberstone. The company is seeking a fixed assessment for taxation purposes covering a period of ten years. An addition of 500-barrel daily capacity, costing 500,000 dollars, will probably be begun next March, if the necessary by-law is passed by the township ratepayers when it is voted on in January.

REFERRING to the new Fushun oil plant, the *Manchuria Daily News* says that the satisfactory working of the plant has been noteworthy and testifies to the thoroughness with which every point was covered in manufacture, transportation, storage, sale and delivery, not to mention the treatment of its various by-products. A substantial appropriation of Yen 13,000,000 for the second stage expansion has been adopted by the Fushun Collieries management, to extend over the fiscal years 1931–32, independently of the collieries' enterprise estimate for the new fiscal year 1931.

IT is reported in the *Chemical Trade Journal* that plans are well advanced for the development of one of the richest shale oil areas in South Africa. A new company is being formed under the title of Vergelegen Shale Oil and Mineral Company, with a capital of £15,000, the objects being to extract crude oil from shale in the vicinity of Underberg, Natal. Machinery has already been ordered from Scotland, and is expected to arrive in April or May. The deposits are stated to be the richest in South Africa and very extensive. The company expects to distil 2400 gallons of oil daily.

A MESSAGE from Zurich states that in view of the difficulty which the Swiss watch and clock industry is experiencing in selling its products—the turnover during 1930 being about 25 per cent. lower than it was in the year before—the industry intends to effect a partial transformation of itself and adapt some of its works to the manufacture of typewriters and calculating machines, which, up to now, have been principally purchased from Germany. It is hoped that the Government will protect the industry during the transformation period by the imposition of import duties.

ADVANCE agents of a syndicate of electrical manufacturers, with head offices in New York, have arrived in Buenos Aires to take part in an initial canvass of the South American markets for the sale of electrical machinery and appliances on an unprecedented scale. In Argentina electric refrigerators are found in most of the large stores, shops, and better-class private houses, and several new installations have been made in hotels and apartment-houses. The representatives appear to be in possession of ample funds for advertising, and their energies are being directed mainly towards active competition with Swedish electric refrigerators.

A BY-LAW providing for an extension of the municipal central heating system, at a cost of 750,000 dollars, was approved by Winnipeg ratepayers recently. Since the introduction of this service in 1924, the Manitoba capital has achieved great success in the heating of large sections of the city from a centrally situated plant, which serves as a standby steam-electric generating station and also utilises surplus or off-peak hydro power for the generation of steam in electric boilers for heating purposes. The station is operated by the Winnipeg Hydro-Electric System and has been a success in supplying steam for heating in the warehouse and business sections of the city.

A TUNNEL is being driven from the Wolfe's-avenue termini under the city of Quebec to join the main line at St. Malo, just outside the city limits. Work on the whole project, which will cost some 2,000,000 dollars, was begun during last summer. Over 1000ft. of pilot tunnel have been driven from each end, while the bore has been developed to its full size for a distance of about 250ft., both at St. Malo and Champlain-street, and the placing of the concrete lining has been begun. Care is being taken to blend the tunnel mouths into their surroundings, and when the concrete portals are completed the new traffic link will in no way detract from the scenic beauty for which the territory has so long been famous.

THE American Telephone and Telegraph Company has made an application to the Federal Radio Commission for permission to construct stations for a short-wave wireless telephone service between the United States and Bermuda. The transmitting station would be at Lawrenceville, N.J., quite near the transmitters used for a similar service to Europe and South America, and would have a power of 500 watts. The receiving station would be at Netcong, N.J., near the European and South American receiving stations, and designed for automatic volume control. The service would be handled in Bermuda by the Imperial and International Communications, Ltd., working in conjunction with the Bermuda Telephone Company.

SOME LOCOMOTIVES OF 1930

(*For description see page* 18.)

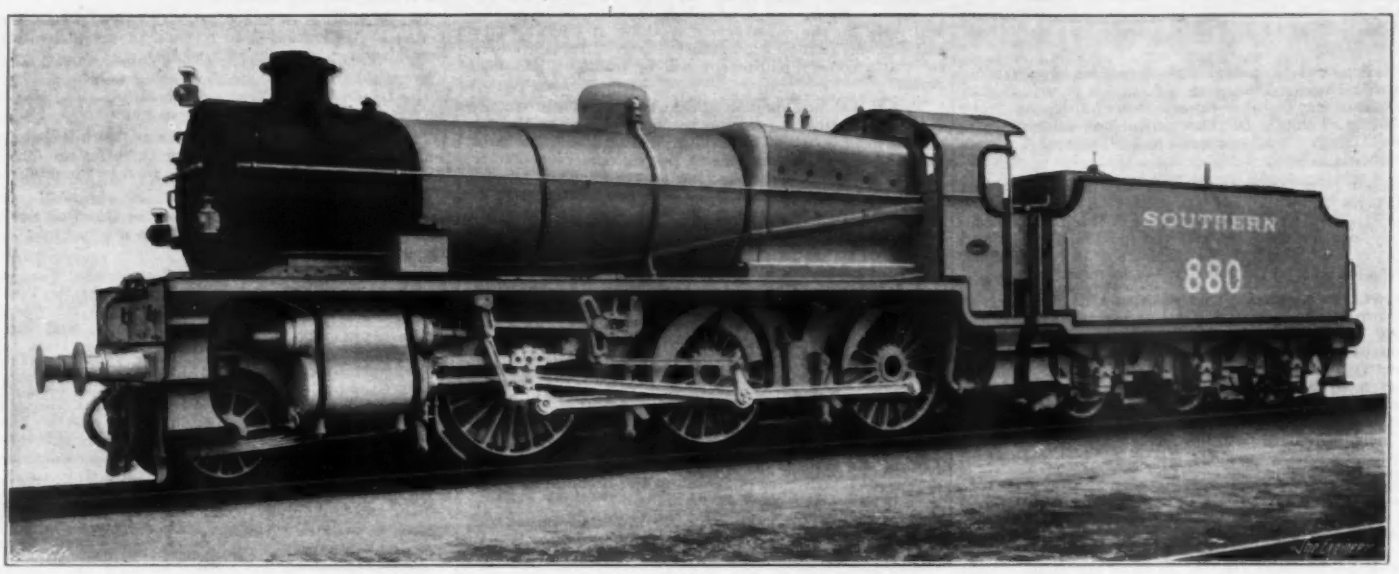


FIG. 1—SOUTHERN RAILWAY—THREE-CYLINDER MIXED TRAFFIC LOCOMOTIVE

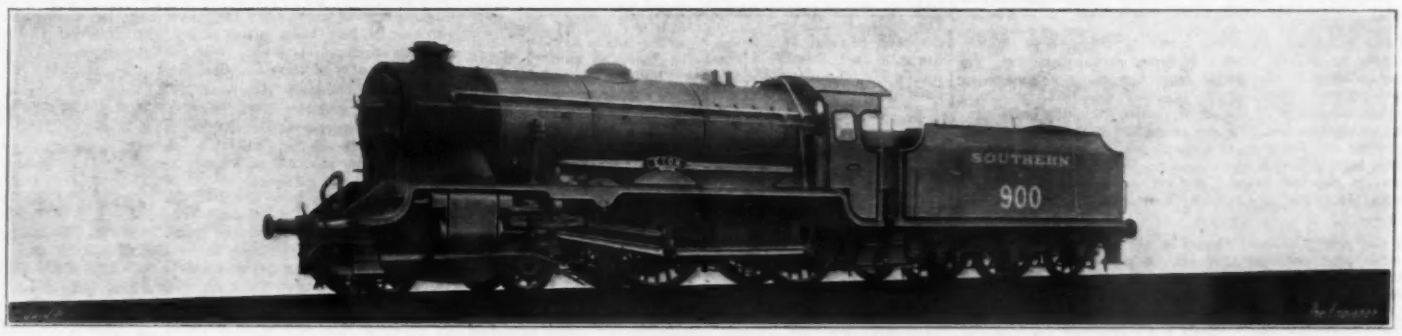


FIG. 2—SOUTHERN RAILWAY—"SCHOOLS" CLASS EXPRESS LOCOMOTIVE

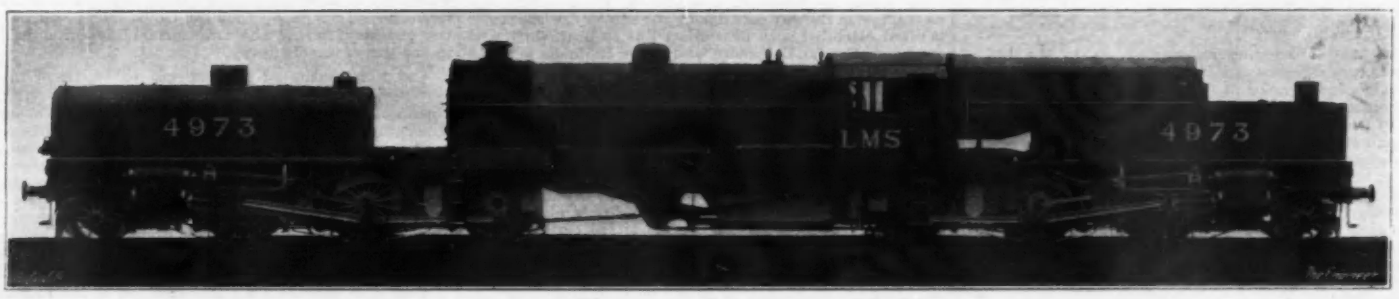


FIG. 3—L. M. & S. RAILWAY—BEYER-GARRATT LOCOMOTIVE

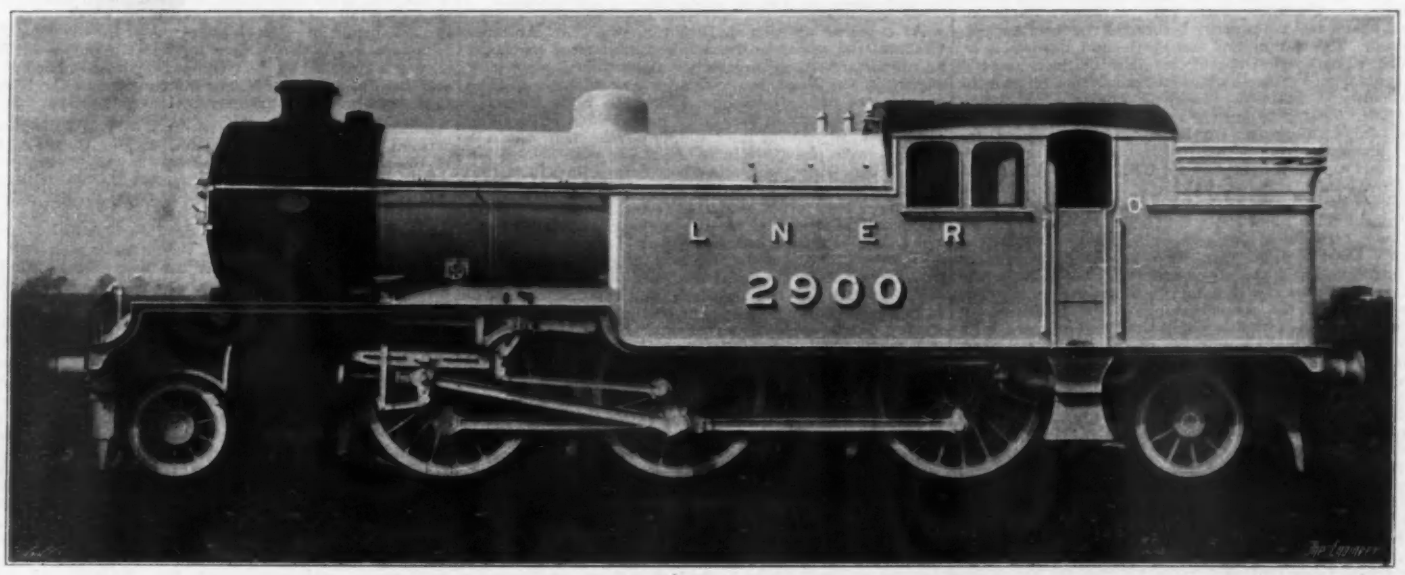


FIG. 4—L. & N. E. RAILWAY—THREE-CYLINDER TANK ENGINE

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† M. 605	
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* Fr. 418	Banque, 22
† Fr. 390	PARIS : Librarie Berger-Leverault, 229, Bld.
	St. Germain
	PARIS : Brentano's, 37, Av. de l'Opera
	PARIS : Dunod, 92, Rue Bonaparte
	PARIS : W. H. Smith and Son, 248, Rue de
	Rivoli
GERMANY ..	BERLIN–LICHTERFELDE–WEST : H. Her-
* R. mks. 70·00	manns, Dahlemer Strasse 64 A
† R. mks. 65·00	WESTERN GERMANY : Fritz Rehfus, Blumen-
	thalstrasse 10, Cologne
	LEIPZIG : K. W. Hiersemann, Konigstrasse 29
HOLLAND ..	ROTTERDAM : Hector's Boekhandel, Noord-
* Fl. 41·00	blaak 59
† Fl. 38·00	ROTTERDAM : Techn. Boekhandel, "Plan C,"
	Gelderschestraat 4
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* Rs. 45	CALCUTTA : Thacker, Spink and Co.
† Rs. 42	
ITALY	MILAN : Ulrico Hoepli
* Lire 300	ROME : Maglioni and Strini, 307, Corso
† Lire 280	ROME : Fratelli Treves, Corso Umberto 1, 174,
	ROME : Fratelli Bocca
	TURIN : Rosenberg and Sellier, v. Maria
	Vittoria 18, and their Branches at Naples
	and Rome
JAPAN	Maruzen Co. All Branches
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DEATH.

ON December 20th, 1930, at Monte Carlo, ROBERT JAMES FRECHEVILLE, M. Inst. C.E., M.I.M.M., consulting mining engineer, in his 84th year.

THE ENGINEER.

VOL. CLI No. 3912

JANUARY 2, 1931.

1930—A Retrospect.

SEVENTY-FIVE years have passed since THE ENGINEER was published for the first time. Age is not much esteemed in these days, and we should mention our birthday with some diffidence did we not feel that whilst the years have added much to our experience they have robbed us of none of our vigour. The policy which inspired this paper in the beginning still prevails. Its object is still to give trustworthy information about the events of the time in all branches of the industries which it represents, to combine technology with science, not to be led aside by ephemeral movements, but to watch and follow all those, either in the domain of technology or economics which, based on careful reasoning, hold out a promise of stability. It is sometimes said of the most illustrious newspaper in the world—a paper with which, we are proud to say, THE ENGINEER, in its own field, is sometimes compared—that it never speaks till it is sure. By some that is accounted a defect; but the more sober majority, which does not ever seek the illusory sparkle of novelty and sensation, recognises that a solid staff upon which one may lean is more to be desired in the serious affairs of industry than a "clouded cane."

A Very Bad Year.

As we glance back over the long period of our existence, we are unable to discover any year which resembles that which has just ended. Wars have, of course, had their effects upon the engineering industries. Some of our older readers, with their memories refreshed by our weekly record of the events of "Sixty Years Ago," may recall 1868 in which the repercussion of the American Civil War was felt; but it was a year of panic, not one in which the sickness of industry had, after slow degrees, seemed to reach its height. The attack then came suddenly and as quickly went. The Franco-German War was blessedly short, and though for a time it disturbed the engineering trades, the depression, again, was not akin to that in which we are still involved. Indeed, though there have been periodical "booms" and "slumps," with an occasional year of exceptional severity, we do not believe that in the whole history of the mechanical engineering and metal trades any parallel can be found for the conditions which now prevail. There has been no panic in this country to account for it. There is no single obvious cause. It is as though anæmia had overcome industries; they have slowly wasted away. We must observe, too, that the complaint is practically world-wide; even the United States, after a period of great activity superposed upon the early years of our depression, crashed something more than twelve months ago. The Continent of Europe is in a bad way, too, and the Dominions overseas are fellow-sufferers. The world has stopped buying.

Unemployment.

In the past, years of depression were always accompanied by great suffering amongst the work-people deprived of the means of making a livelihood. It may be that that very suffering led to its own cure, and that for that reason the bad periods were shortened. Actual misery and want have now been removed by State insurance, and, in a measure, the spur to seek work has been taken away. During the past year the British scheme was bankrupt; the funds subscribed by employers and workpeople were exhausted, and Parliament voted large sums which involved the levying of increased taxation and added to the burden which weighs upon the British manufacturer and increases his difficulties in meeting competitors in foreign, and even in the home, markets. It was to be expected that a socialistic Government would augment social services and show little consideration for the capitalist; but it was, at any rate, hoped that that Government would recognise the undesirability of prosecuting its schemes at a time when industry required to be helped rather than hindered. Actual distress has, it is true, been removed, but in the removal of it industries have been damaged, and unemployment increased. At the very moment in industrial history when economy was called for, the Government has been extravagant. Instead of insisting that the standard of life must, if anything, be lowered in order that the country may pass safely through a period of depression, it has attempted to raise it. The consequence is seen in works without orders, shops and stores without customers, a middle class with unemployment always facing it, and a working class that by subsidised idleness is losing the habits of industry.

Protection.

In times of trouble, men seek the remedy in the means nearest at hand. Whilst the factories of this country stand idle, foreign products are still being imported, and it is argued that if the influx of foreign goods could be arrested there would be so much more work for the home manufacturers. That theory gained great impetus during the year. It may be said that the industrial community as a whole is solidly in favour of Protection, even the workpeople in many districts favouring it. But the Government defies the wishes of the industrial centres, and not only refuses to grant the extension of protective tariffs, but threatens to remove the safeguarding which now exists. That it has some reason for its obstinacy cannot be gainsaid. Great Britain is in an exceptional position. It flourished exceedingly under Free Trade and no one can foresee with certainty what the ultimate effect of Protection would be. It can scarcely be denied that many manufacturers regard it as a device for price maintenance. They see foreign goods coming in at a price below theirs, and seek a tariff with the main object of preventing themselves being under-sold. Their argument is that the goods are marketed at an uneconomic price—that they are "dumped." They cannot retaliate because the foreign exporters' markets are closed against them by tariffs. But that effect does not prevail upon a common neutral market. Upon such a market we ought to be able to compete in price, and, say what we will, we must be in a position to do so. A tariff which leads to price maintenance cannot help us one whit, for we cannot exist on home trade alone. What we refuse to buy from the foreigner, he will sell, in competition with us, to the neutral. Manufacturers are familiar with this line of thought, and their reply is that if the home market can be made safe for them, then the increase of output will reduce the proportion of overhead charges, and enable quantity production methods to be introduced. Hence, the total cost of manufacture will fall, and they will be able to do just what the foreigner does. The argument is a fair one, but, assuming that the best possible was achieved, is it

conceivable that British ironmasters, to take but a single example, could compete in price with those of Czechoslovakia, with labour costs between forty and fifty per cent. less than ours, and a far lower burden of taxation? We have elected in this country to give our people a high standard of living—much higher than prevails generally in Europe. To give it, we have not only to pay a high rate of wages, but every article produced is burdened with heavy local rates and a grossly excessive income tax. The taxation per head on the population, excluding local taxation, is almost twice as high in Great Britain as in Germany, about two and a-half times as high as in Belgium, over four times as high as in Italy, and more than twice as high as in the United States. Such heavy taxation not only hampers industry by adding to the costs of manufacture, but, furthermore, it induces investors to place their money abroad, and deprives the home manufacturers of the capital required for extensions and developments. Whatever may be the possibilities inherent in Protection, it can never attain its full purpose as long as it is regarded as a means of maintaining high prices in order to meet an excessive burden of taxation and rating.

The Imperial Conference.

During the year the movement for a closer commercial union between all parts of the Empire was greatly accelerated. The Empire suffices for its own needs and a commercial ring around it would do harm to none of the parts, but would benefit all. It was hoped that some useful steps towards the effecting of such a union would be made at the Imperial Conference, which opened on October 1st, but the Secretary of State for the Dominions and Colonies showed early in the proceedings that he had no intention to foster such a scheme, and the Cabinet rejected the tentative advances made by the Dominions.

Technical Progress.

Following our usual course, we devote the greater part of the current issue to a review of the technical progress that took place during the year. It was not a fruitful year, either at home or abroad, in the industrial field, though it holds to its credit the completion of a few great civil engineering works, notably the closing of the arch of the great Sydney Harbour Bridge on August 18th. The limitation of navies had begun to show its effect some time ago, but last year it fell with full force upon many engineering firms, which found the plant laid down rendered useless, and their men without employment. The locomotive industry also suffered heavily, presumably by the reduction in traffic, but it is a strange fact that for several years locomotive manufacturers all over the world have been short of orders. Why that should be so is by no means clear. It can only be accounted for by supposing that railway companies are making their engines last longer than before, owing to the necessity for economies. Manufacturers take that view, for they hold that if the orders are not given now they will have to be given in greater numbers later on. If that is really so, there would seem to be occasion for the exercise of greater foresight. Excess capacity may be easily created by the unnecessary concentration of orders which could be, by a little management, placed over a longer period. In shipbuilding, the most notable event of the year was the laying down of the keel of the new Cunarder very early in December. She had been long under discussion, but at length her dimensions have been settled, and it has been decided to use steam turbine propulsion. In the air, if we omit the disaster to the "R 101," which, we say without regret, has set back the building of airships for many a day, the construction of a forty-seater aeroplane and a forty-seater flying boat has naturally attracted most attention. But because such vessels are in a measure sensational, we must not be blind to the fact that they do really indicate the direction in which progress must be sought. We are convinced that it is rather by such large flying machines that commercial air transport will be attained economically than by airships.

Of all engineering industries, the only one that really flourished during the year was that connected with the various branches of electricity distribution. Whatever may be the result of the "grid" to consumers, there is no question that, combined with the standardisation of frequency, it has been a god-send to manufacturers. There is no super-power station to the credit of the year, but, as we show elsewhere, the Chelsea station is making progress, and full particulars of the smoke-cleansing plant have been made public. It is reported that the removal of noxious constituents is likely to be reasonably complete, but we should like to have confirmatory evidence that the effluent from the cleansing plant will have no effect upon the river. The first steps towards the erection of a large station at Fulham have been taken. Opposition on the grounds of injurious fumes was raised against it, but in view of the understanding that the Chelsea plant will prove effective, and that a similar or improved plant is employed, construction will no doubt be sanctioned.

It is pleasant to be able to record that the machine tool industry was fairly active throughout the year.

Conclusion.

We all laugh at the bucolic scientist who connects a change for the better with the new moon, yet each one of us commits folly of the same order with the passing years. There is no reason why the state of industry on January 1st should differ from that on December 31st, but, nevertheless, we make the illogical division. We feel, little as it is true, that we are passing out of an old phase into a new, that we have closed one volume and opened another. We look with anxiety to what it may contain, and seek in the book just ended for indications that the crisis has passed and that better times are ahead. It would be exceedingly rash to make any such conclusion at the present moment. Indeed, there are those who profess to foresee three or four months of a still deeper depression, but, as the old proverb has it, "the deepest shadows are always under the lamp," and there are some reasons for looking with reasonable hopefulness to a better year. It is a familiar fact that whilst prices are falling, business is bad because the purchaser always puts off buying till to-morrow in the hope of an even better bargain. But sooner or later the time comes when the purchase must be made. That time must be near at hand. The world cannot cease to buy indefinitely. Once it is again in the market, prices will rise or harden, purchasing will accelerate, and the long-awaited recovery will begin. There are faint signs that that course of events is opening; prices in some industries have ceased to fall, whilst in others the unequal struggle to sell at less than manufacturing cost has led to a shut-down of factories, and their effect upon the market has therefore come to an end. For these reasons, small as they are, we look with some hopefulness to the coming months, ever praying that Parliament may have the wisdom to give the industries that peace and stability which they so greatly need.

Locomotives of 1930.

It was an uneventful locomotive year. The four companies produced no novel engines, and the private builders struggled with small order books. Developments stood still. Mr. Gresley's high-pressure engine, described in our last Annual Article, went into service and gave a good account of herself, but Sir Henry Fowler's "Schmidt" type, after a fatal accident with one of the fire-box tubes in February, was immediately withdrawn from service, and is now being partially retubed to a very searching specification. We understand that a greater inclination is being given to the tubes at the crown. The P.L.M. has recently put an engine of similar type into use.

It is unfortunate that the year should have been so lacking in interest, because as containing the centenary of the opening of the Liverpool and Manchester Railway it would have been appropriate that it should be marked by some outstanding event. The Centenary itself was celebrated in Liverpool by an exhibition of relics and models and a pageant, and by a display of ancient and modern engines, in which the reconstructed "Lion" acted the principal part by hauling a "period" train round a course.

Southern.

On the Southern Railway the principal event of the year was the advent of the three-cylinder 4–4–0 type express passenger engines, known as the "Schools" class, of which ten were completed at Eastleigh works, and are numbered "E 900" to "E 909." These are the largest and most powerful engines of their type in the country, and they have proved to be very successful in every way. They are illustrated by Fig. 2, page 16 and Fig. 5. They have three 16½in. cylinders, with a stroke of 26in., and the working pressure is 220 lb. On 6ft. 7in. wheels at 85 per cent. boiler pressure they develop a tractive force of 25,130 lb. The total evaporative surface is 1766 square feet, the superheater surface 283 square feet, and the grate area 28·3 square feet. The drivers carry 21 tons per axle, and the total weight of the engine in running order is 67 tons 2 cwt.; the tender, with 4000 gallons of water and 5 tons of coal, weighs 42 tons 8 cwt.

The Ashford works built five three-cylinder engines of the 2–6–0 type, Nos. "A 876" to "A 880," with 5ft. 6in. wheels for heavy freight and mixed traffic, while the Eastleigh works had in hand twenty similar engines, but with 6ft. wheels for passenger trains, in addition to fifteen three-cylinder freight tank engines of the 2–6–4 type, with 5ft. 6in. wheels. Work was begun at Ashford on the building of ten more two-cylinder engines of the 2–6–0 type, with 6ft. wheels. Of these engines, "No. 880" is illustrated by Fig. 1. It has three 16in. cylinders and 5ft. 6in. wheels, and with 85 deg. of the working pressure of 200 lb., exerts a tractive force of 27,700 lb. The total weight of the engine and tender in working order is 106 tons 13 cwt. These locomotioves are almost identical with the "A 822's" built at Ashford in 1922, but have an independent Walschaerts valve gear for the inside cylinder. They are known as the "N 1" class, to distinguish them from the two-cylinder "N's" and will be used for heavy goods and mixed traffic on the Tonbridge–Hastings line, as, being of reduced width, they can pass through the narrow tunnels on that line.

Owing to the projected electrification of the Brighton main line a number of large express passenger engines will become available for other duties when this occurs, and therefore there are no orders on hand at present for the larger engines.

During the year a considerable number of small passenger tank engines were equipped for working push-and-pull services. Pneumatic control is employed to enable the driver to operate the engine from the driving compartment on the leading vehicle. In cases these trains are being used on feeder services for points on the electrically operated routes.

London, Midland and Scottish.

On this railway the following new engines were put into service:—

No.		Built by.
	Passenger tender engines—	
4	4–4–0 superheated simple	Derby
20	4–6–0 "Royal Scot" class	"
	Passenger tank engines—	
10	4–4–2 Tilbury tanks	"
20	2–6–2 superheated simple	"
	Freight tender engines—	
75	2–6–0 superheated simple	Crewe
20		Horwich
12	0–8–0 superheated simple	Crewe
	Freight Tank Engines—	
4	0–4–0 "Sentinel" shunting locomotives, 100 H.P.	"Sentinel" Waggon Works
	Rail motors—	
1	"Sentinel-Cammell" type, gear driven	"
	Miscellaneous—	
30	2–6–0–0–6–2 "Garratt" articulated	Beyer, Peacock and Co.

From this list it will be seen that 195 new engines and one steam rail motor coach were constructed by and for this company. In addition, a further "Sentinel-Cammell" steam rail car will be introduced on the Axholme line, between Goole and Haxey, which is jointly owned and managed by the L.N.E.R. and L.M.S.R.

The only engine of a new standard type is a 2–6–2 passenger tank, illustrated by Fig. 9. Fifty of these engines are being built at Derby, the first of which was handed over to the motive power department, Derby, on March 19th. They have been designed to give a tractive effort of 21,486 lb., at 85 per cent. of the boiler pressure, and will work suburban passenger trains. With this end in view, twenty of them, which will be allocated to the London district, will be fitted with condensing gear, and also a special vacuum trip cock gear, to enable them to work over the Metropolitan lines. A standard superheated boiler has been brought in, having a grate area of 17·5 square

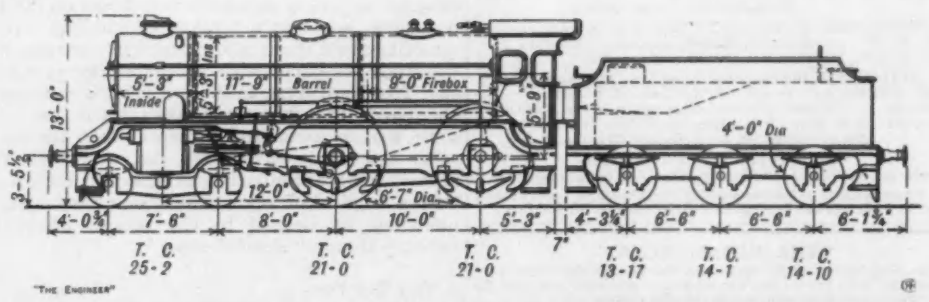
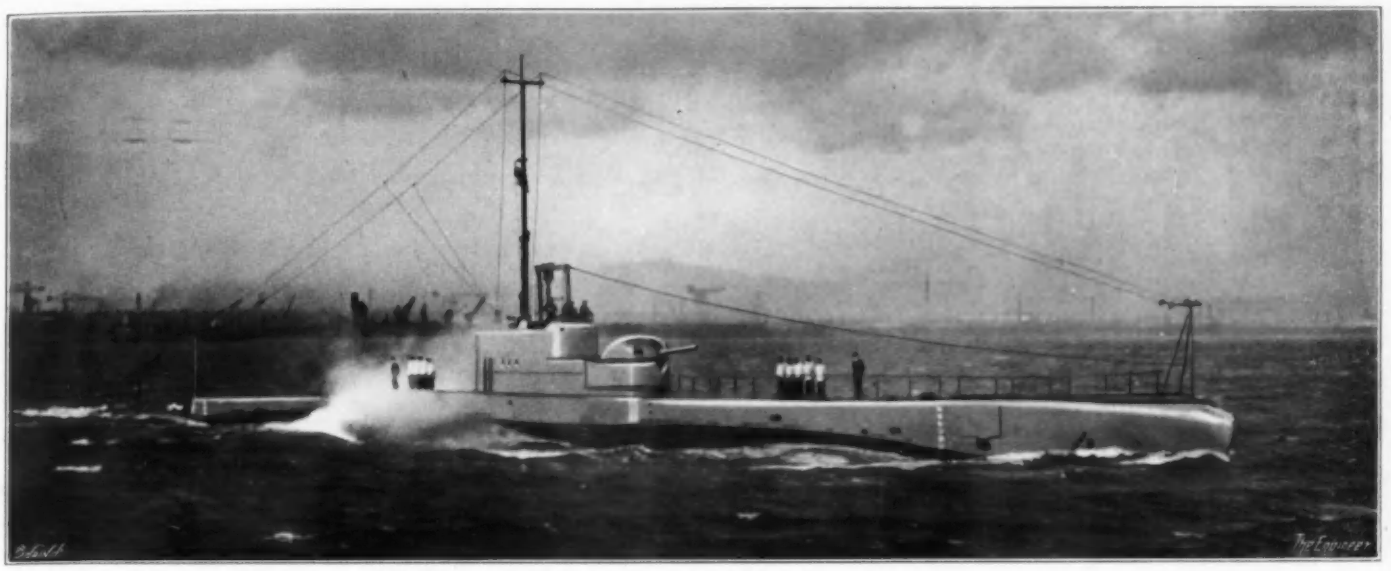
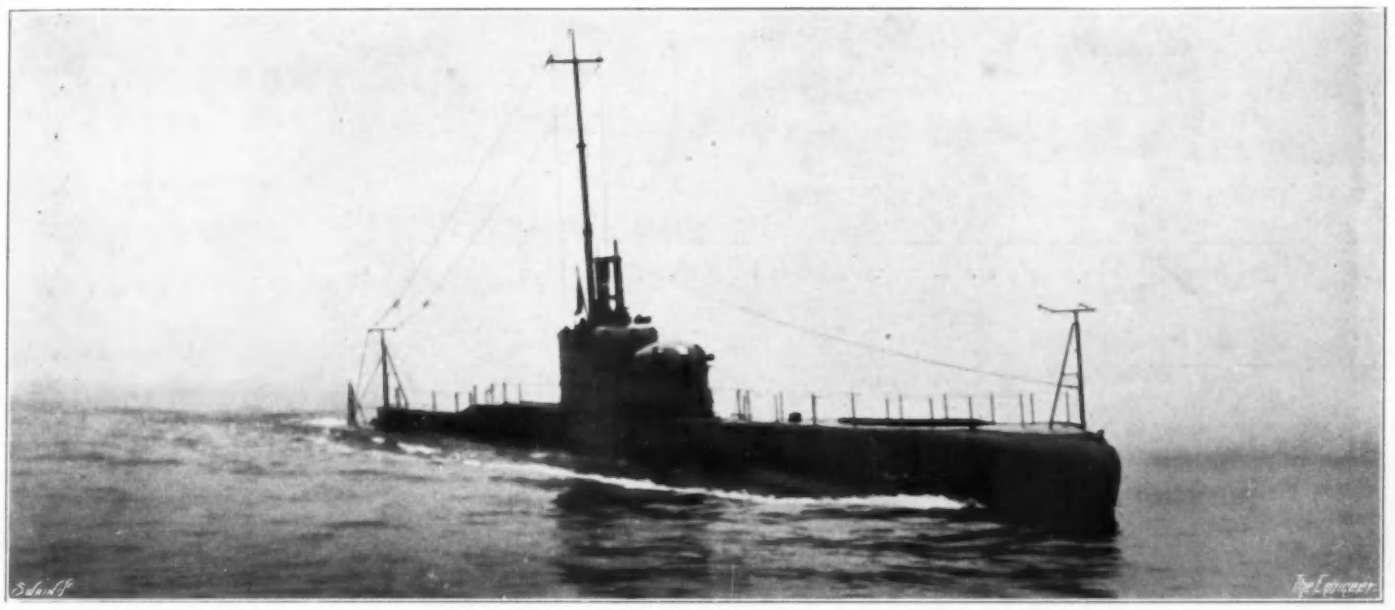


FIG. 5—SOUTHERN RAILWAY—"SCHOOLS" CLASS THREE-CYLINDER LOCOMOTIVE

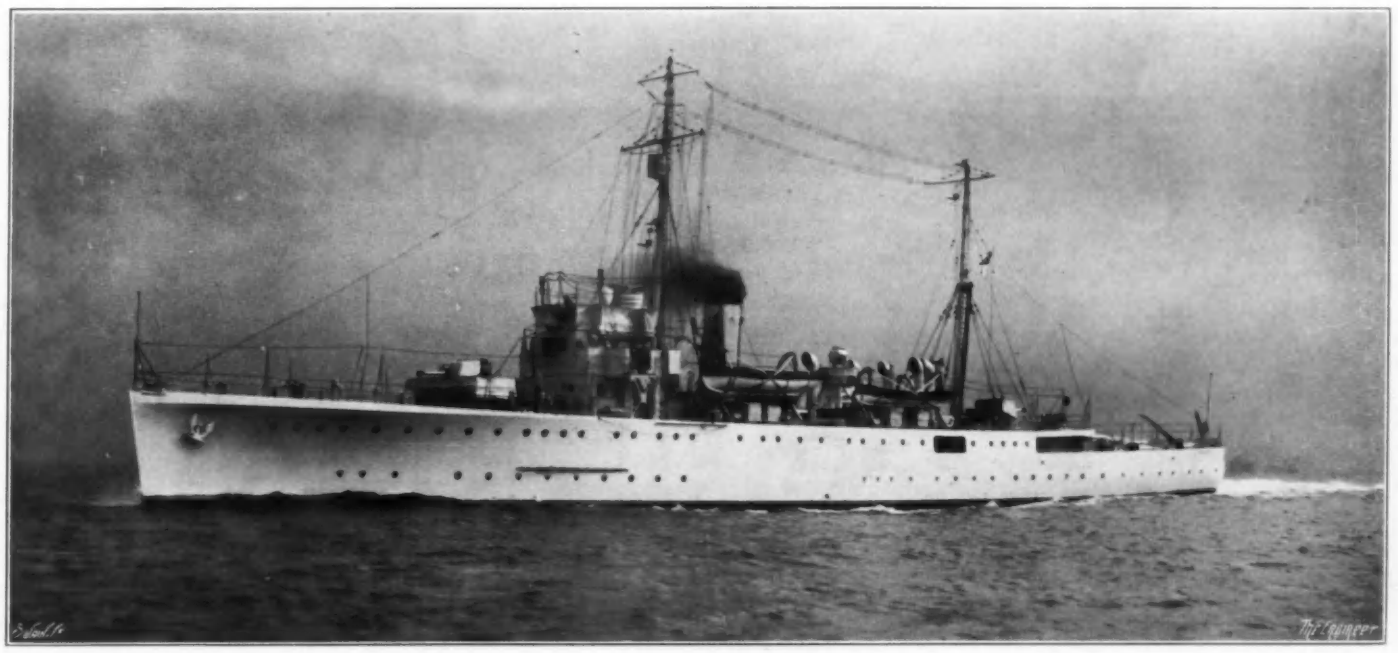
SOME WARSHIPS OF 1930



H.M. Submarine "Regent"

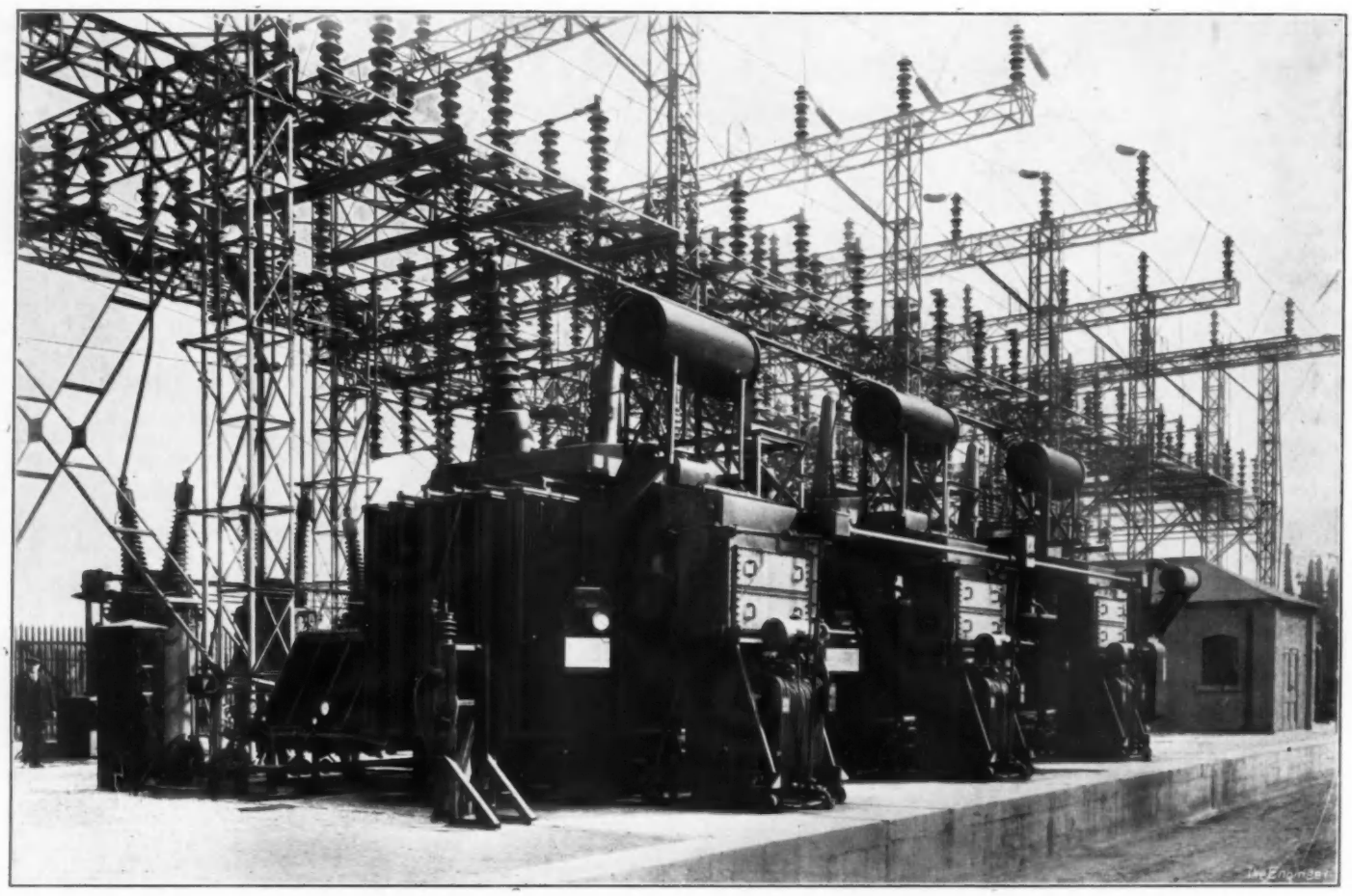


H.M. Submarine "Regulus"

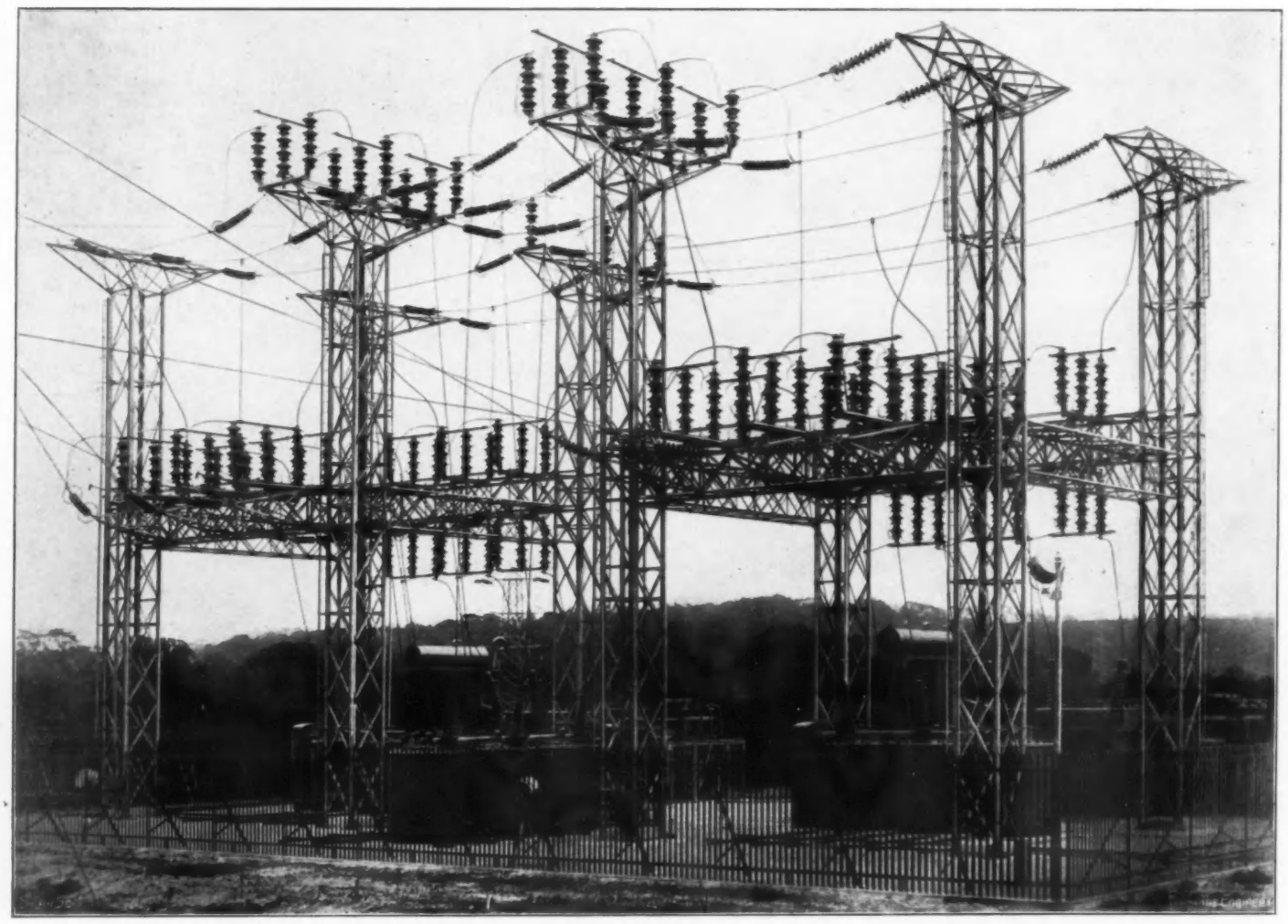


H.M.I.S. "Hindustan"

ELECTRICAL ENGINEERING IN 1930



60,000-kVA Transformer Bank at Dalmarnock Sub-Station

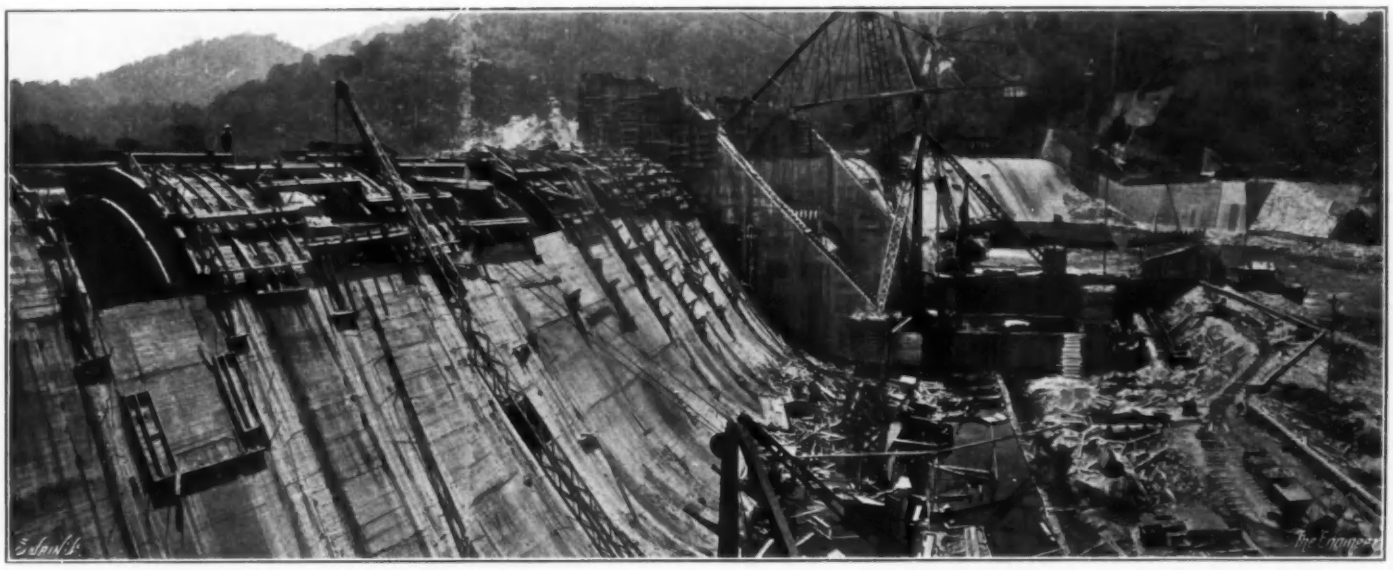


The Luton Sub-Station

CIVIL ENGINEERING IN 1930

Tilbury Landing Stage

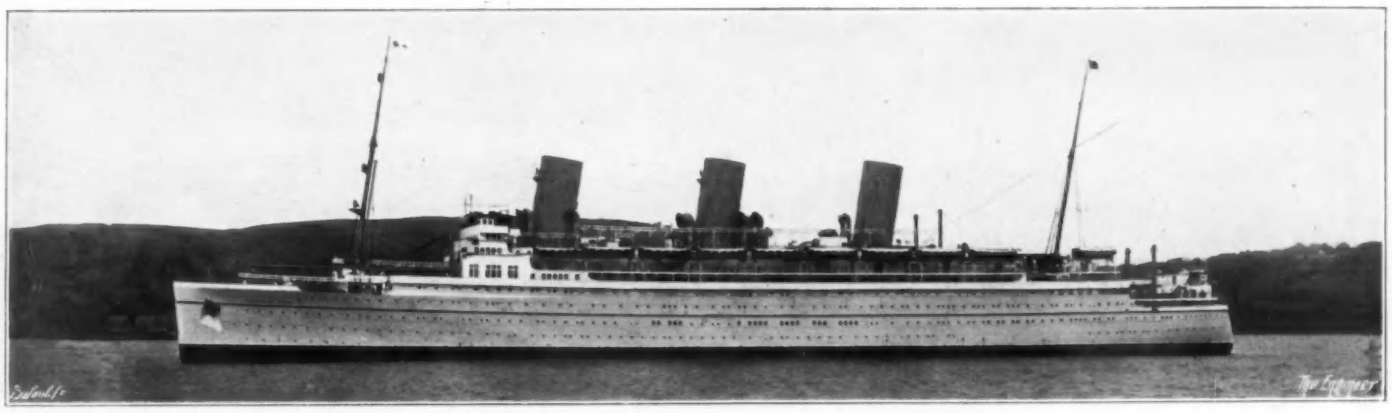
Lifting-Span Bridge at Great Yarmouth



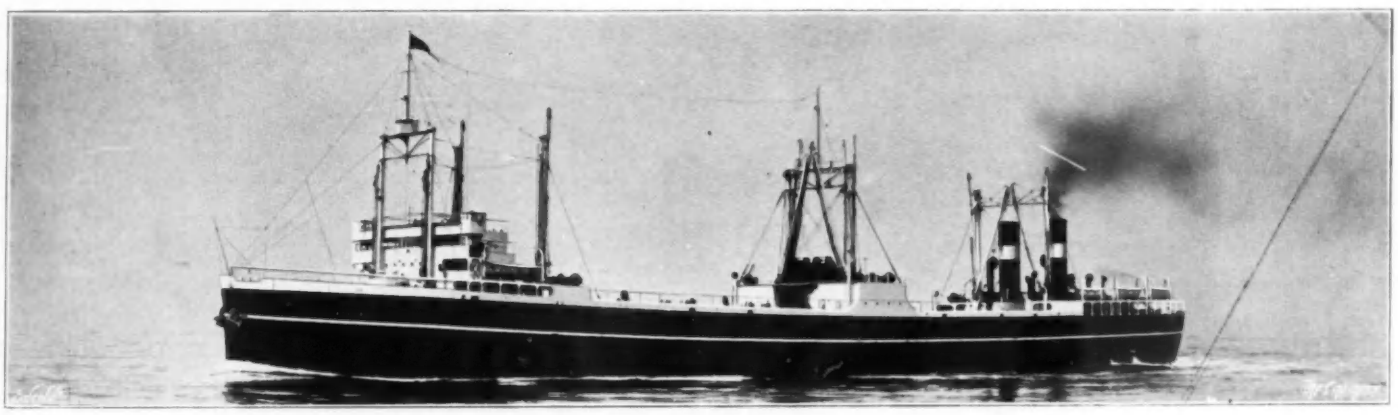
Perak River Hydro-Electric Power Scheme—Dam, June 30th

UNIV. OF MICH.

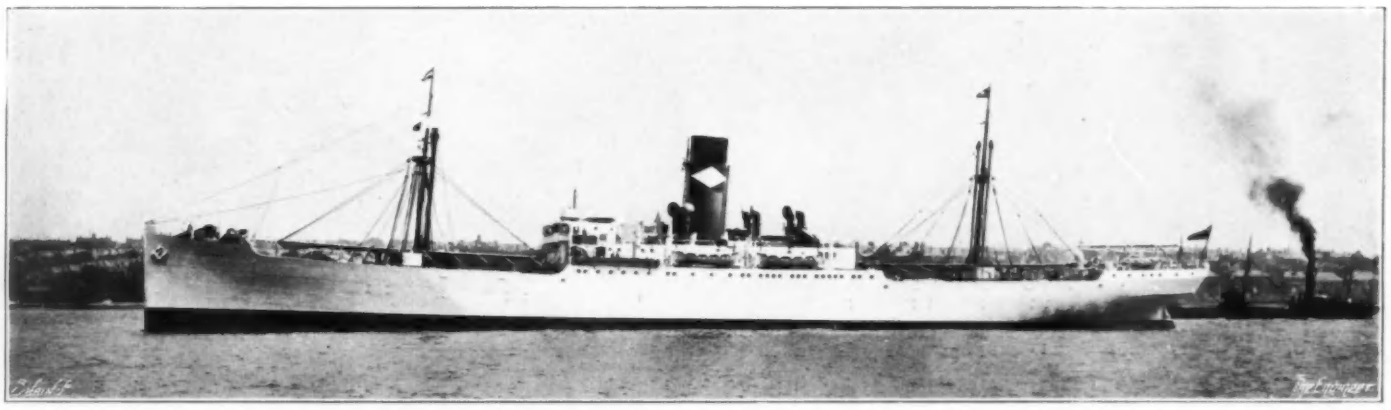
SOME STEAMSHIPS OF 1930



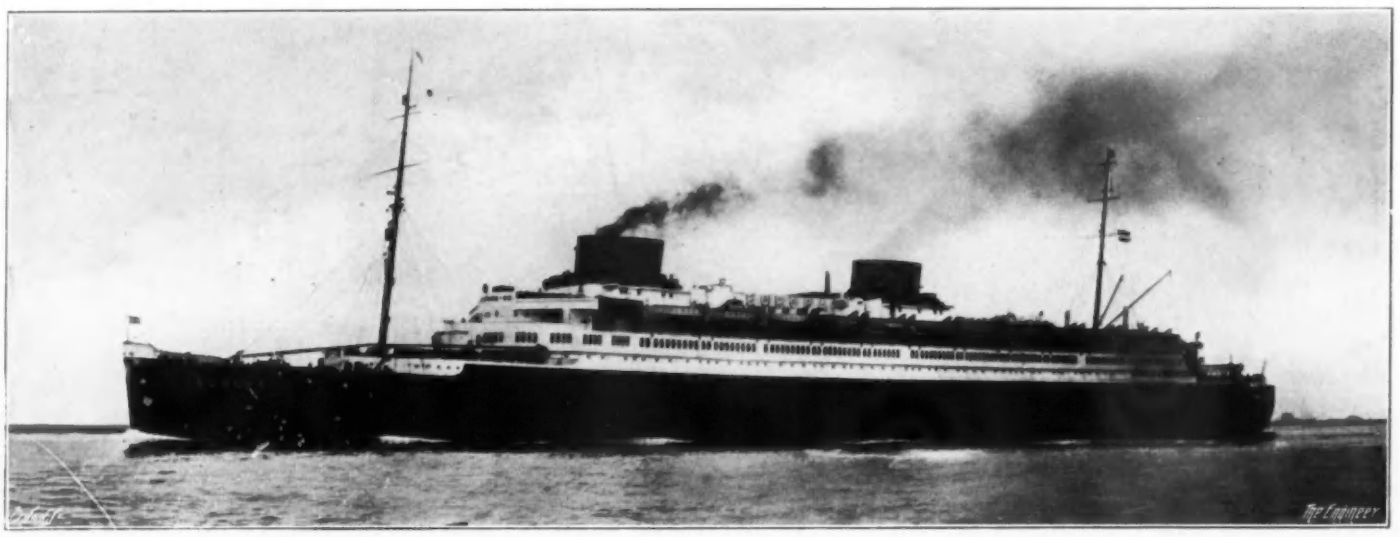
Canadian Pacific Liner "Empress of Japan"



Whaling Factory Ship "Tafelberg"

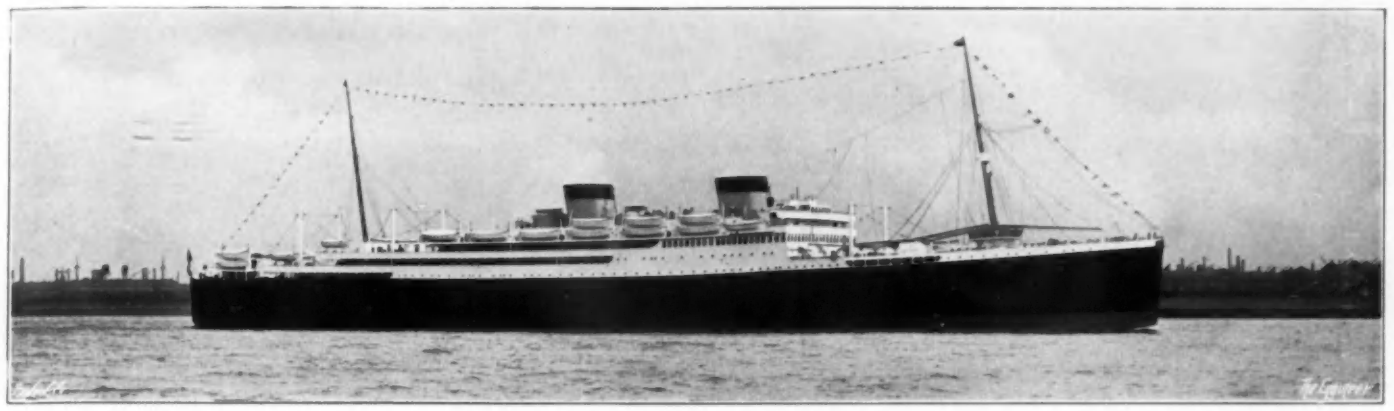


Turbo-Electrically Propelled Fruit Carrying Vessel "Platano"

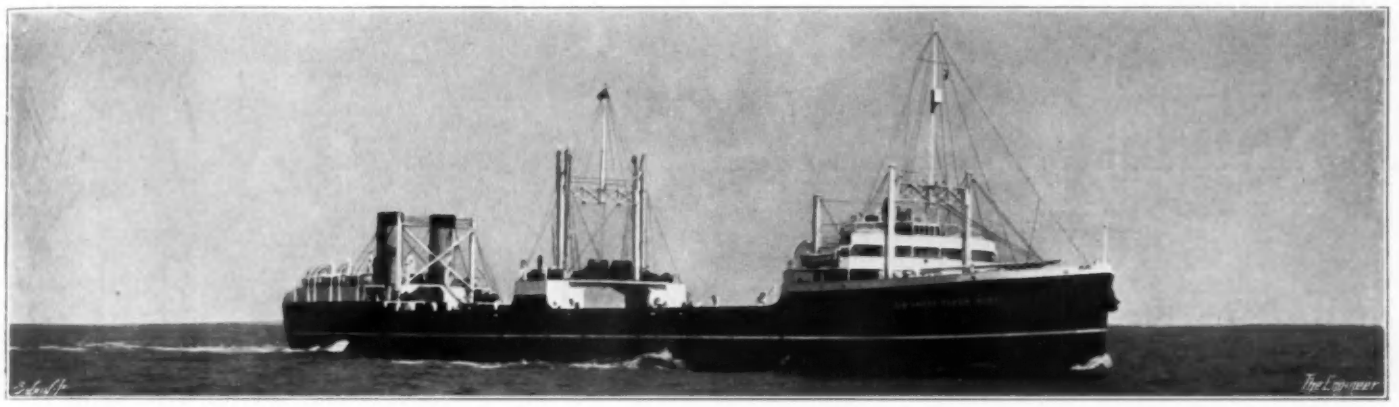


North German Lloyd Liner "Europa"

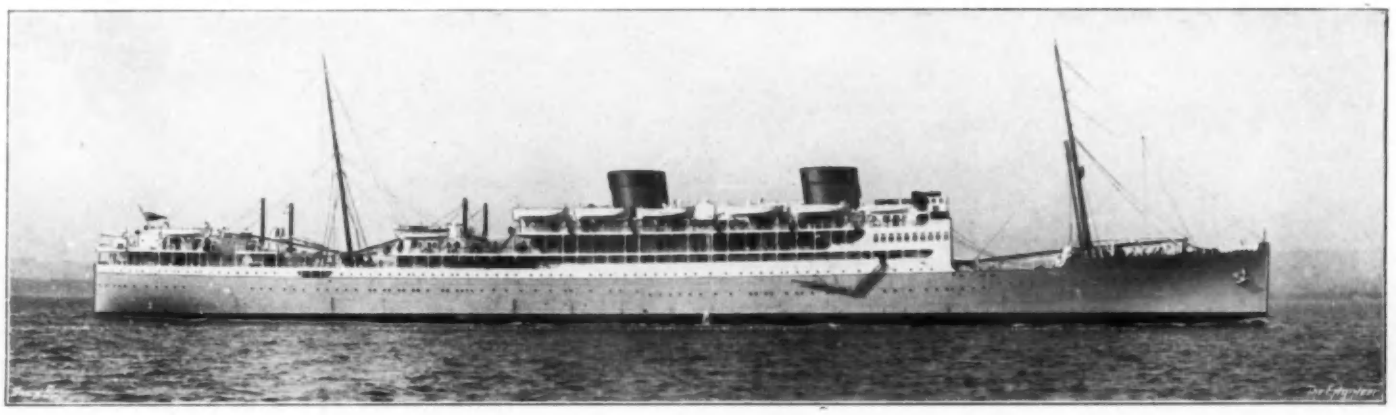
SOME MOTOR SHIPS OF 1930



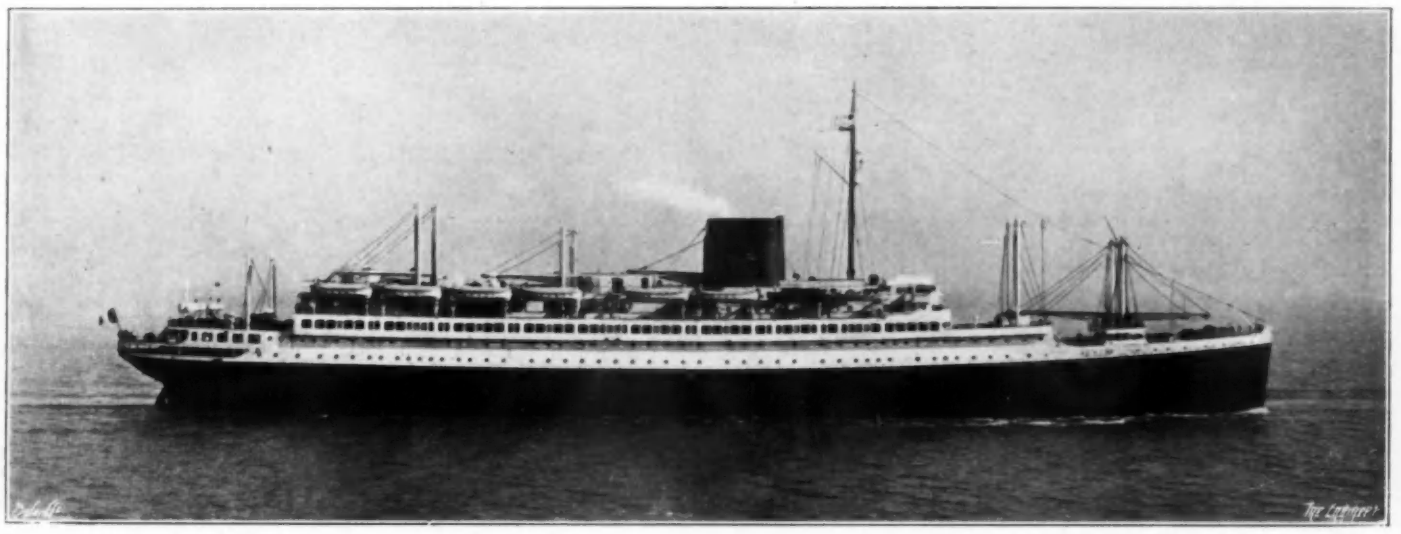
White Star Liner "Britannic"



Whaling Factory Ship "Sir James Clark Ross"



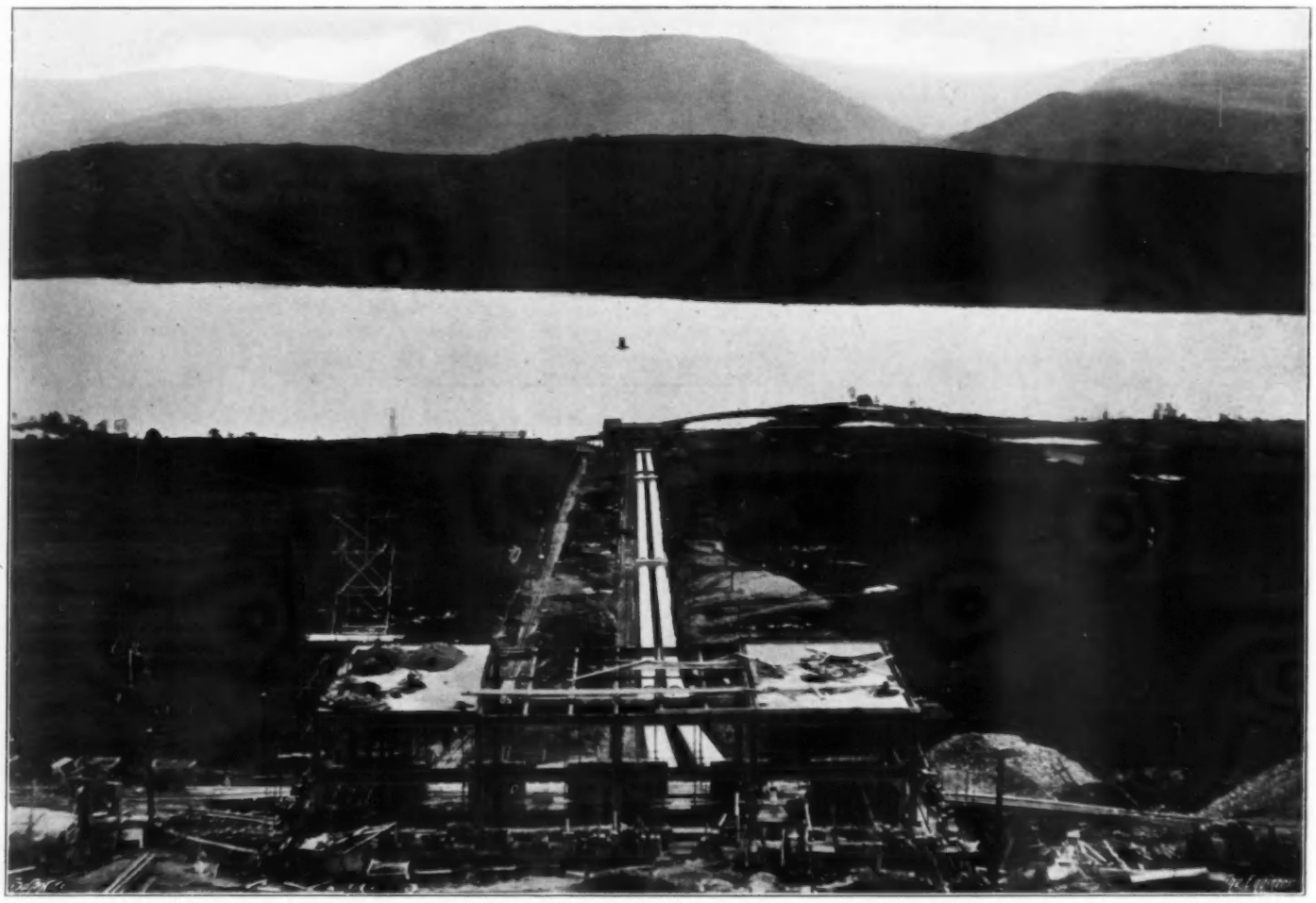
Union-Castle Liner "Winchester Castle"



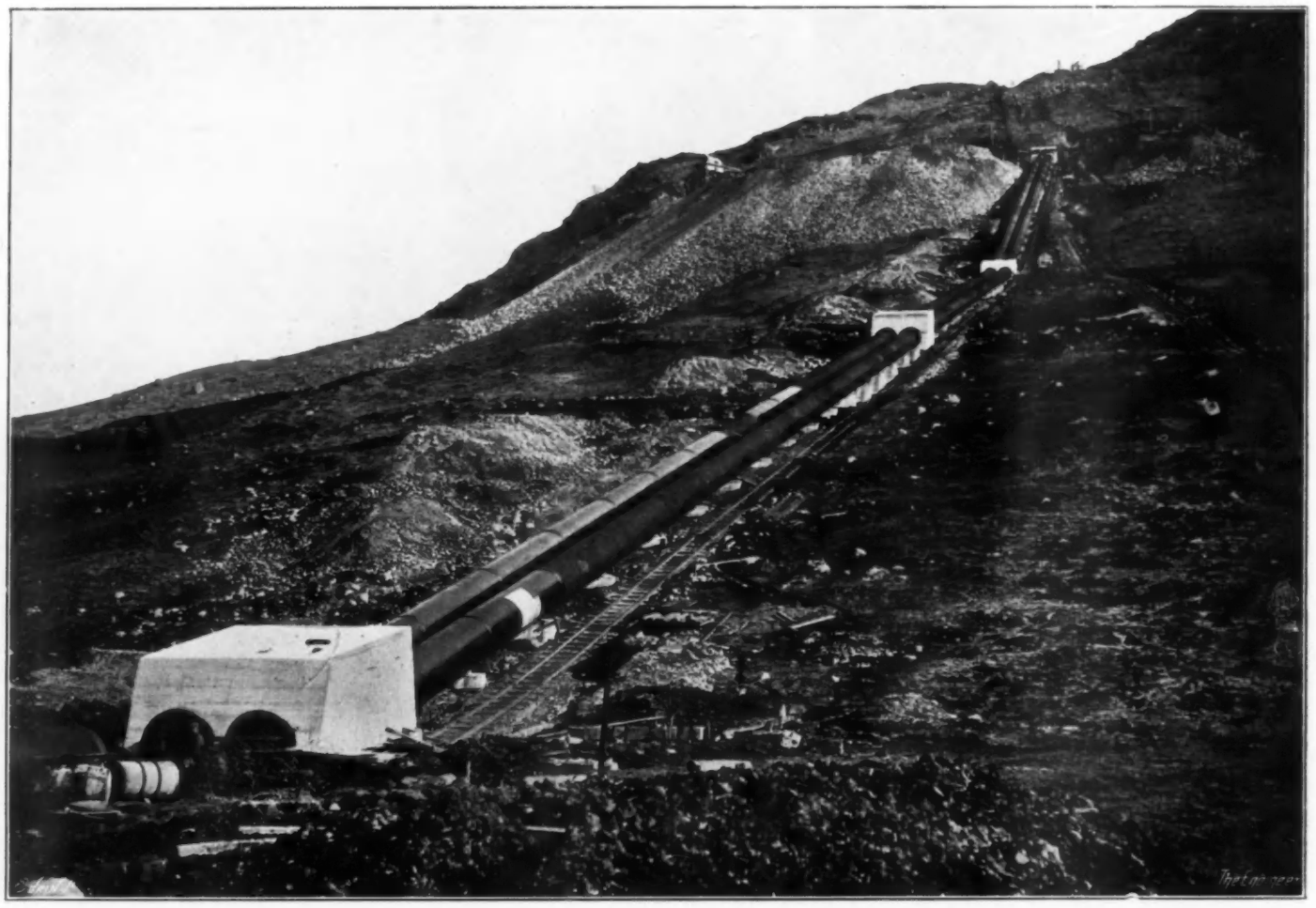
French Line Liner "Lafayette"

UNIV OF

HYDRO-ELECTRIC ENGINEERING IN 1930

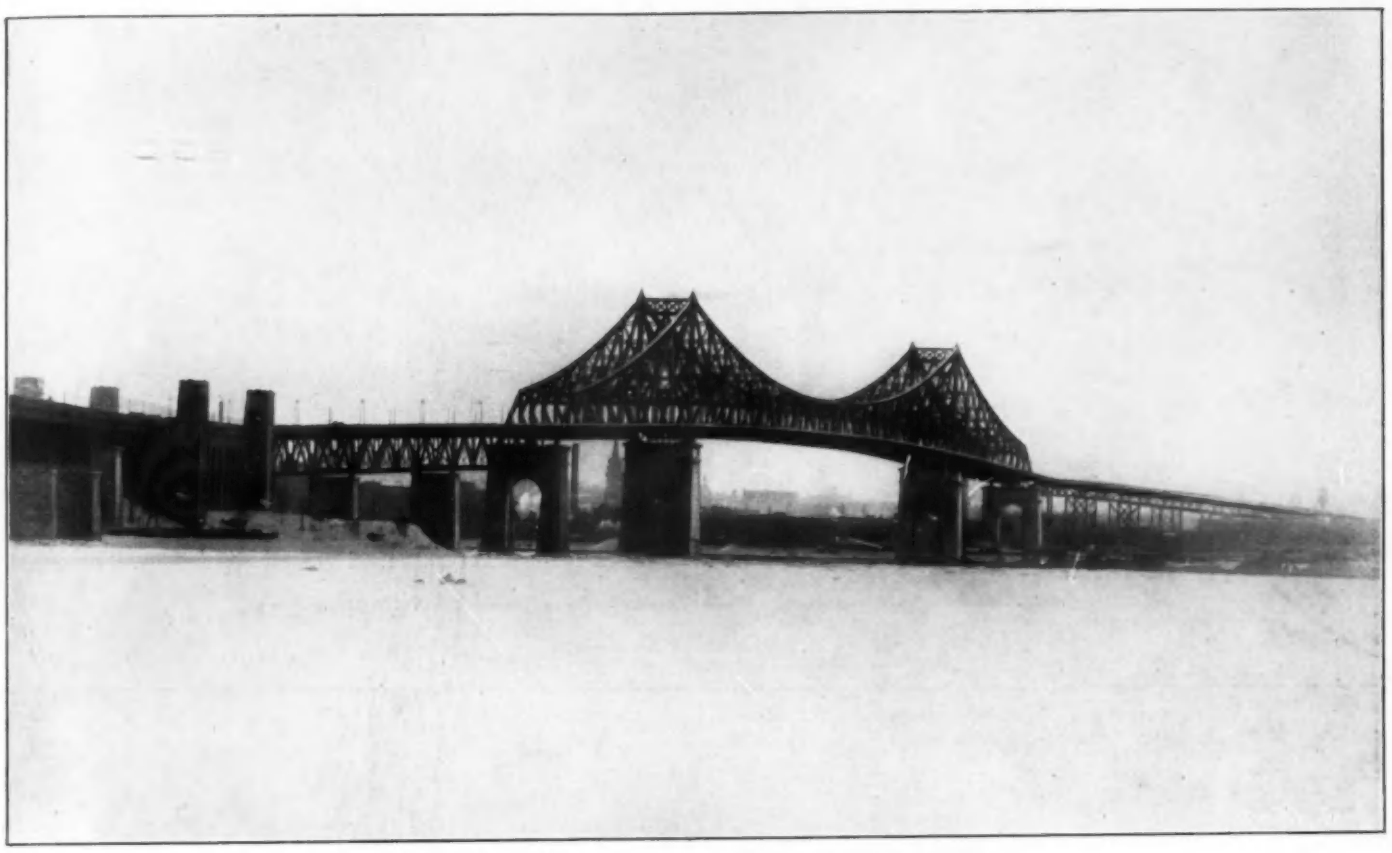


Grampian Power Scheme—Pipe Lines Looking Towards Power-House

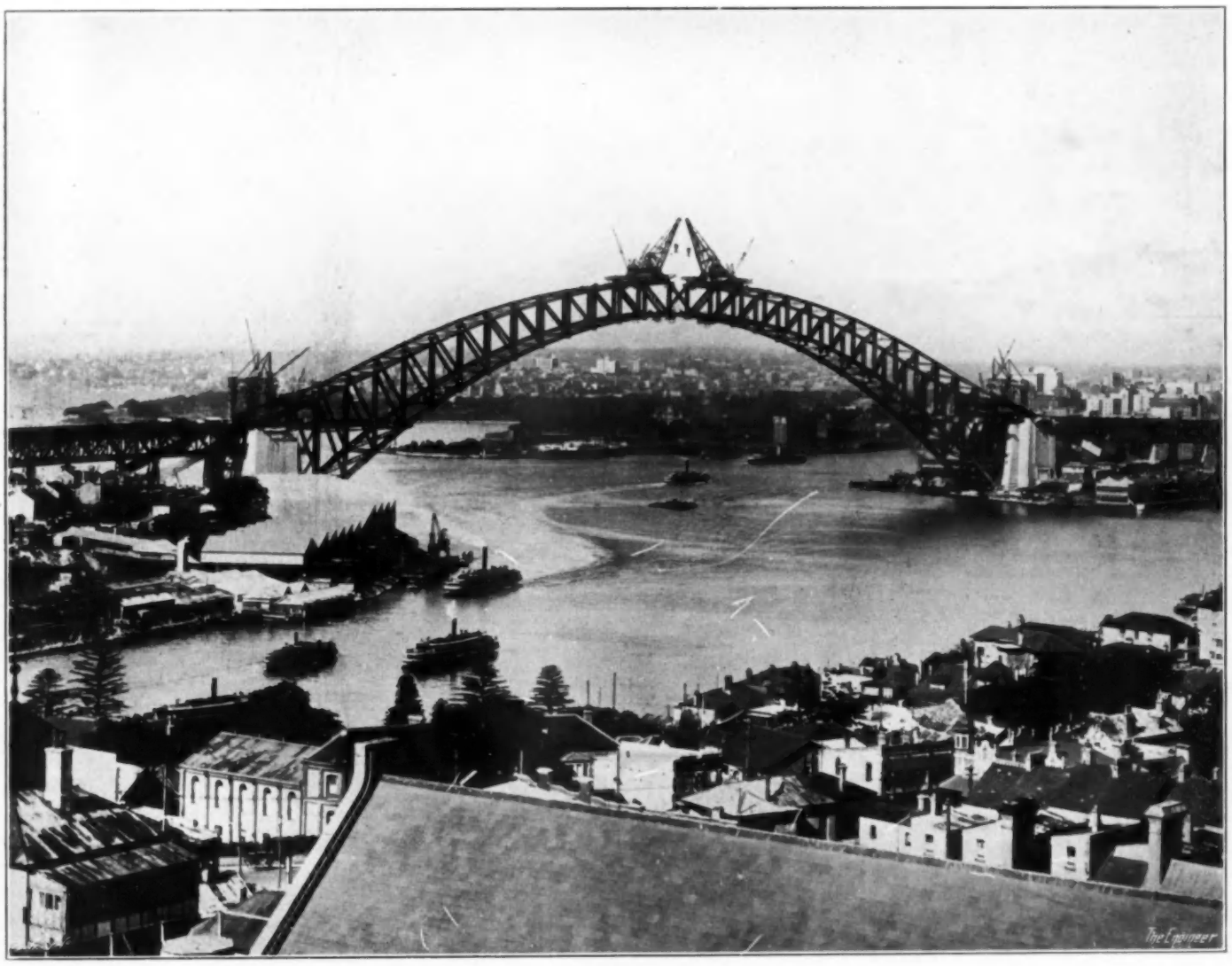


Lochaber Power Scheme—Pipe Lines Looking Towards Tunnel Portal

BRIDGES OF 1930



MONTREAL HARBOUR BRIDGE OVER THE ST. LAWRENCE RIVER



SYDNEY HARBOUR BRIDGE

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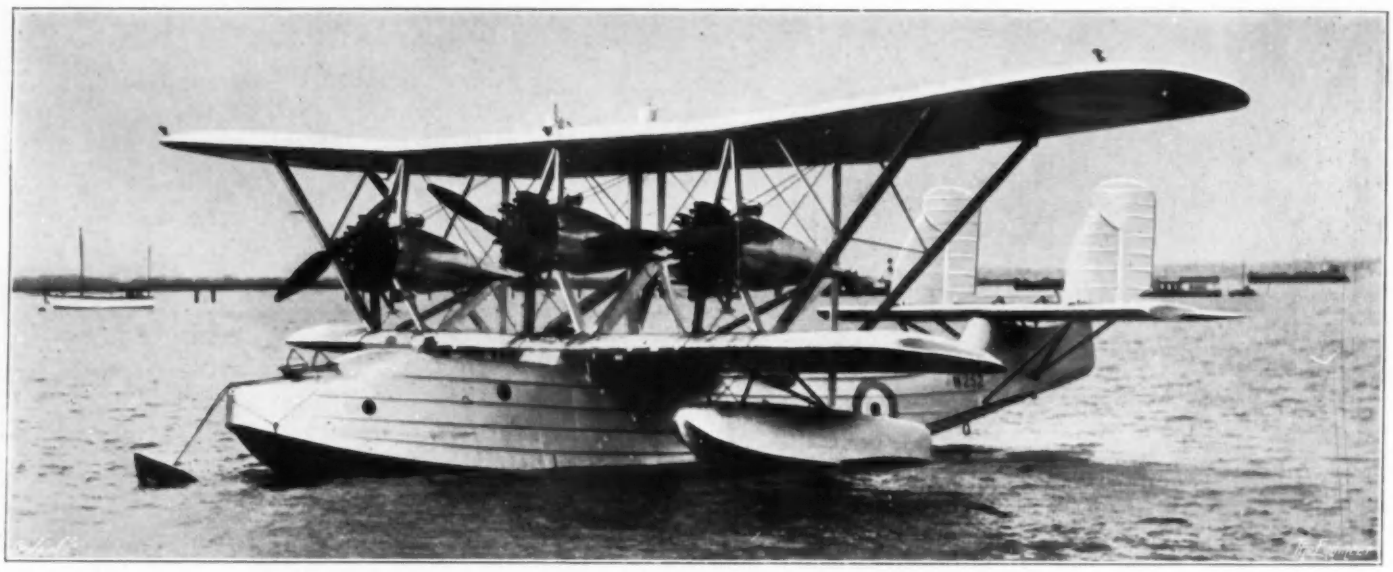
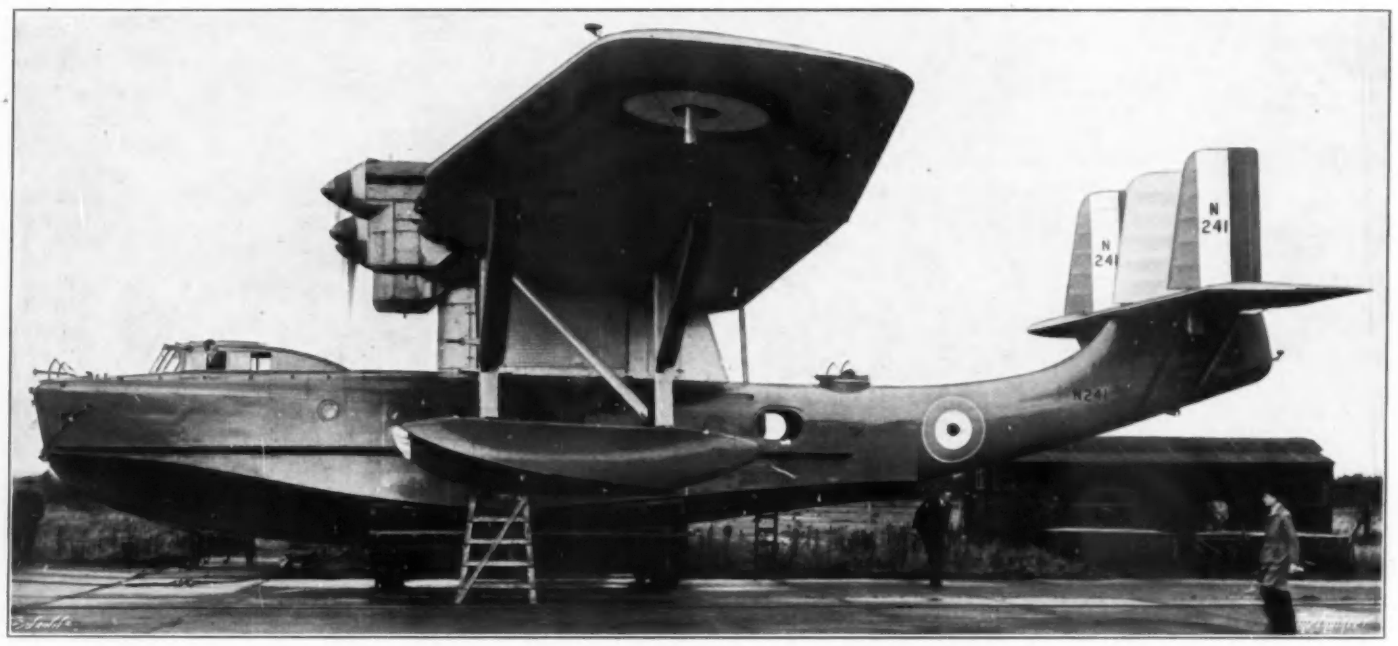
SOME AEROPLANES OF 1930



SUPERMARINE "SOUTHAMPTON" Mk X. THREE-ENGINED BIPLANE FLYING BOAT



BLACKBURN "SYDNEY" THREE-ENGINED MONOPLANE FLYING BOAT

HANDLEY PAGE FOUR-ENGINED FORTY-SEATER PASSENGER BIPLANE

SOME LOCOMOTIVES OF 1930

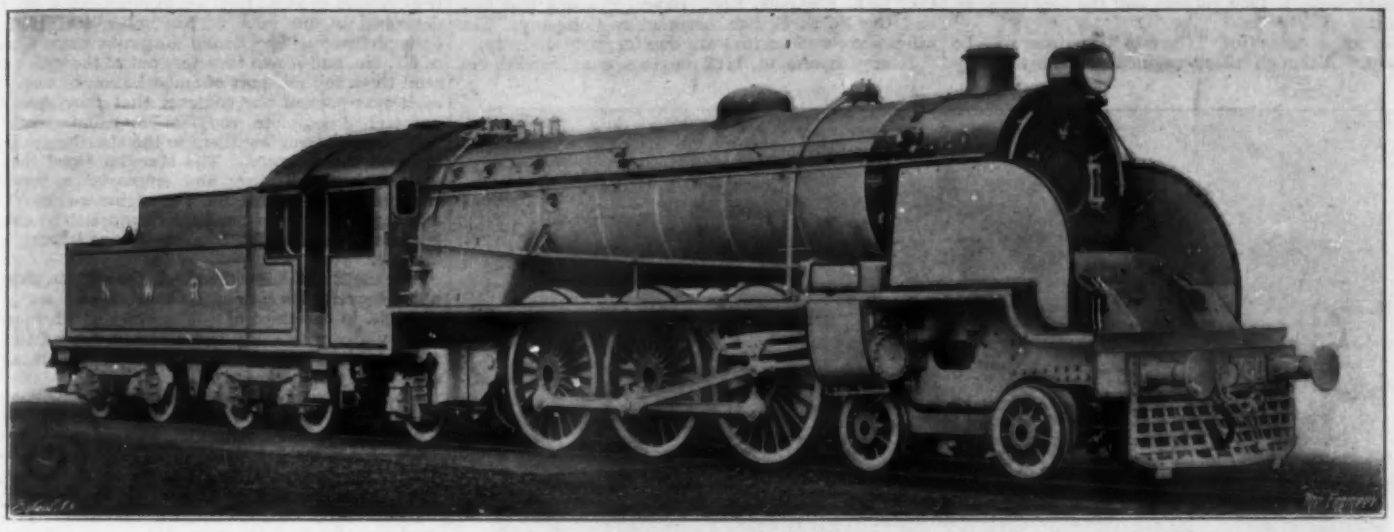


FIG. 6—N. W. R., INDIA—FOUR-CYLINDER ENGINE WITH CAPROTTI GEAR—VULCAN

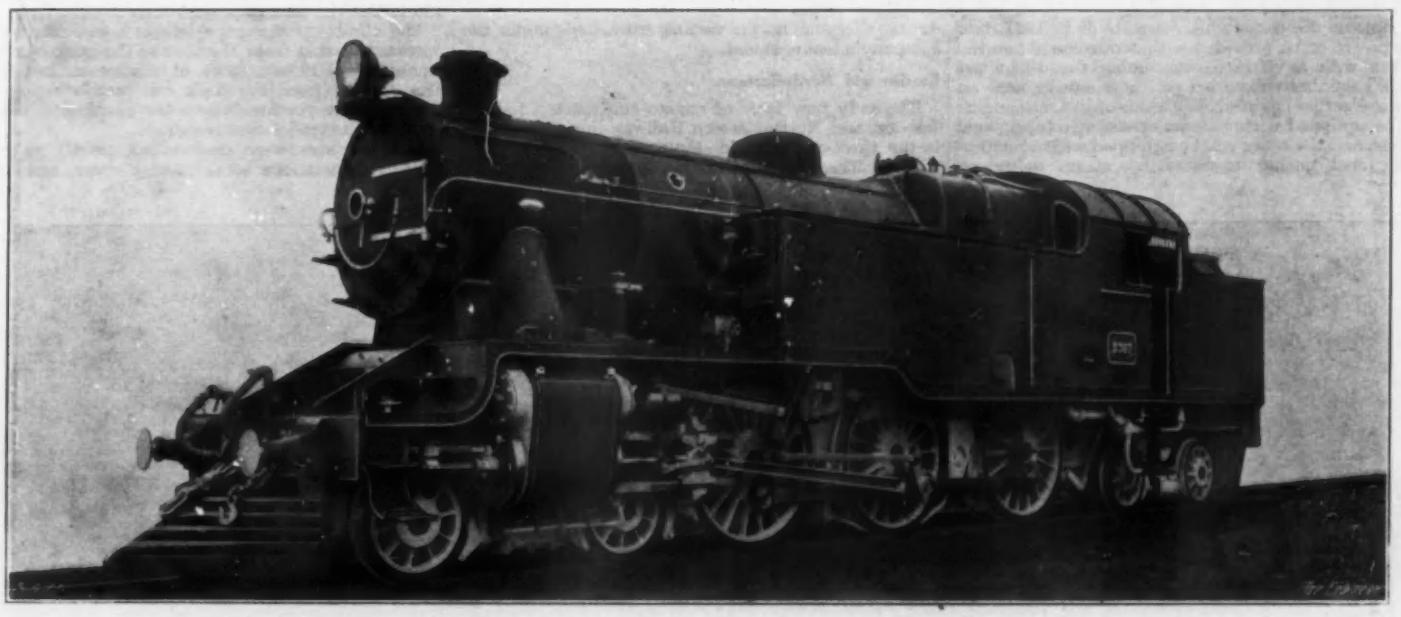


FIG. 7—BUENOS AIRES-PACIFIC RAILWAY—THREE-CYLINDER ENGINE—STEPHENSON

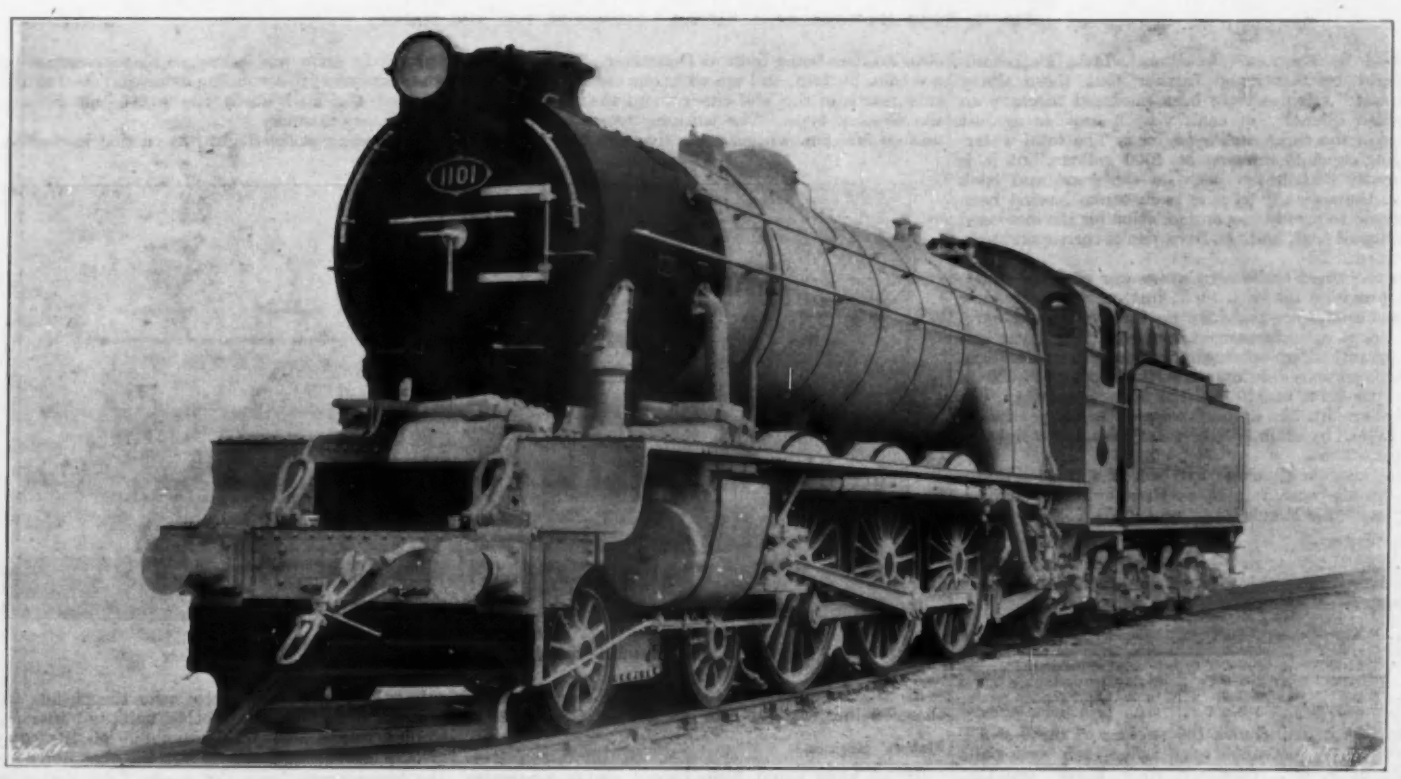


FIG. 8—CENTRAL ARGENTINE RAILWAY—5FT. 6IN. GAUGE LOCOMOTIVE—ARMSTRONG-WHITWORTH

UNIV. OF MICH.

feet. The working pressure is 200 lb. per square inch. The cylinders—two—are 17½in. by 26in., the driving wheels 5ft. 3in., and the total weight—non-condensing engines—70½ tons in running order. The water capacity is 1500 gallons, and the coal capacity 3 tons.

The large order for "Garratt" engines will be noticed. Although these engines are substantially the same as the three which were built in 1927, two of them are being provided with arrangements on the tenders with a view to overcoming the difficulties which have been experienced in trimming coal on the three earlier engines. With this object, one engine will be equipped with a steam-operated rotating coal bunker, and the other will be equipped with a reciprocating coal pusher operated by steam cylinders, supplied by Spencer (Melksham), Ltd., Melksham. It might be mentioned further that these thirty "Garratt" engines have been designed to carry an increased quantity of coal, viz., 9 tons as against 7 tons in the three earlier engines. The total water-carrying capacity remains at 4500 gallons, but it is differently distributed between the front and back tanks, the capacity of the back tanks having been decreased to provide accommodation for the increased quantity of coal, and the front tanks correspondingly increased.

On the three earlier engines water pick-up scoops were provided for each tank, but on the thirty new engines scoops are provided on the front tanks only. The scoops are so arranged, however, that water can still be picked up when running in either direction.

These engines develop a tractive effort of 45,620 lb. at 85 per cent. of 190 lb.—the boiler pressure. The drivers are 5ft. 3in. in diameter and the four cylinders are 18½in. by 26in. The total running weight is 152 tons 8 cwt.

We may add that two of the four-cylinder Claughton's were rebuilt as three-cylinder engines. They are "Sir Frank Ree" and "No. 5971."

Great Western.

During the year new locomotives of the following types have been put into service on the Great Western Railway :—

No.			Engines.
10	"King" class,	4–6–0 type, 4-cyls.	Express passenger
15	"Hall" "	4–6–0 " 2-cyls.	Express passenger
30	"5100" "	2–6–2 T type	Suburban passenger
20	"5200" "	2–8–0 T "	Heavy tank goods
20	"2251" "	0–6–0 "	Light tender goods
148	"5700" "	0–6–0 T "	Light tank goods

The last item includes 100 engines of the 0–6–0 T "5700" class, of which twenty-five each were built by Bagnalls, Ltd., Stafford; Kerr, Stuart and Co., Stoke; the North British Locomotive Company, Glasgow; and the Yorkshire Engine Company, Sheffield; and thirty-three of a new contract for 100 additional engines of the same class, which was equally divided between Armstrong, Whitworth and Co., Ltd., Bagnalls, Ltd., Beyer, Peacock and Co., and the North British Locomotive Company. The other sixty-two engines are due for early delivery.

Heavy repairs to 1162 engines were carried out during the year at the various workshops under the company's management.

London and North-Eastern.

The only new type of engine constructed for the London and North-Eastern Railway during the year is the three-cylinder side-tank engine illustrated by Fig. 4. These locomotives are known as the "V1" class and are being built at Doncaster. The cylinders are 16in. by 26in. and are all in one casting. The outside gear is of the Walschaerts and the inside gear of the Gresley type. The working pressure is 180 lb., and on 5ft. 8in. wheels a tractive effort of 22,464 lb.

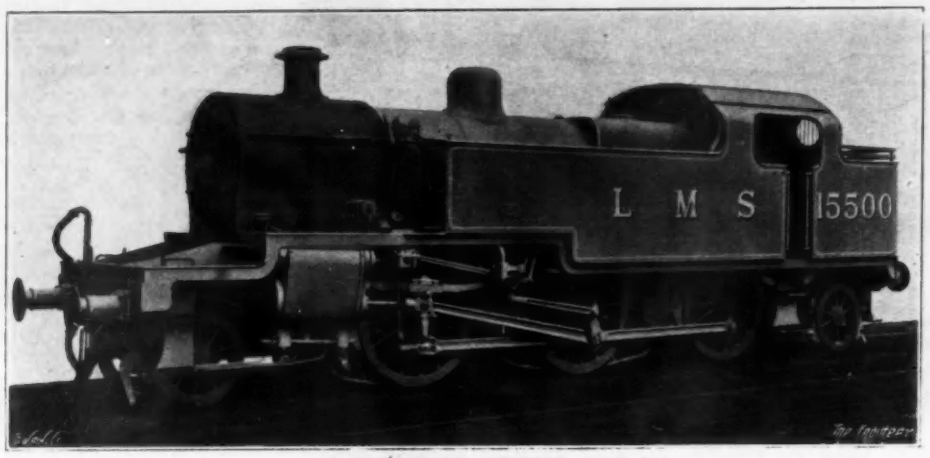


FIG. 9—L.M. & S. RAILWAY—PASSENGER TANK ENGINE

turned out by private firms, but there is, at least, an interesting event in connection with one group of them.

In June the Sudan Government Railways ordered from Kitson and Co., Ltd., six locomotives of the type described in our issue of November 4th, 1927, for early delivery. The Sudan Railways have a gauge of 3ft. 6in. and it was therefore out of the question to send them to their port of embarkation by rail. But as it was part of the contract that they should be despatched complete ready for immediate work, the bold course of sending them to the Manchester Docks by road was adopted. The Marston Road Services undertook the haulage and employed a Scammell truck as shown by Fig. 10. The engine weighs 53 tons and the truck 32 tons, and the distance to be covered is about 40 miles, the Pennine Range having to be crossed.

For the first 5 miles the rise is from 110ft. to 550ft. at Gildersome, close to which town there is a gradient of 100ft. in one-third of a mile, after which there are steep places with sharp turns, but in view of the rear steering and the low gear ratio, such difficulties were successfully overcome.

Seven miles further on at Cooper Bridge, the clearance was not more than 15ft. 4in. above the road level. The locomotive is 12ft. 4½in. high. The lorry itself was lowered till the underside of the carrying girders was no more than 2in. from the ground. It then moved forward at a very slow rate indeed so that the top of the load could be taken care of by the guidance of one of the crew placed in an observation post for that purpose.

The Huddersfield district was passed at a rate of 2 to 3 miles per hour by a route which skirts the town and misses the congested part of the traffic.

The climb up Stanedge followed, and the trying portion was that from Marsden to the peak, reaching an altitude of 1250ft., 650ft. of which occur in 4 miles. The descent from the peak was largely repetition, but there are portions where the maximum braking power of the vehicle was required.

The journeys were undertaken mainly in good weather, but on one occasion very severe conditions prevailed; snow was falling, so that a traction engine was sent out with a winding drum and steel cable and lowered the load down the worst hill in a most satisfactory manner.

Off-loading at the docks was carried into effect by using the hydraulic gear to lower the girders to the ground, detaching the motive unit and interposing sloping ramps, connecting the rails on the carrying girders to the temporary rails on the quay and running the locomotives down this ramp. All the journeys were carried out without any mishap.

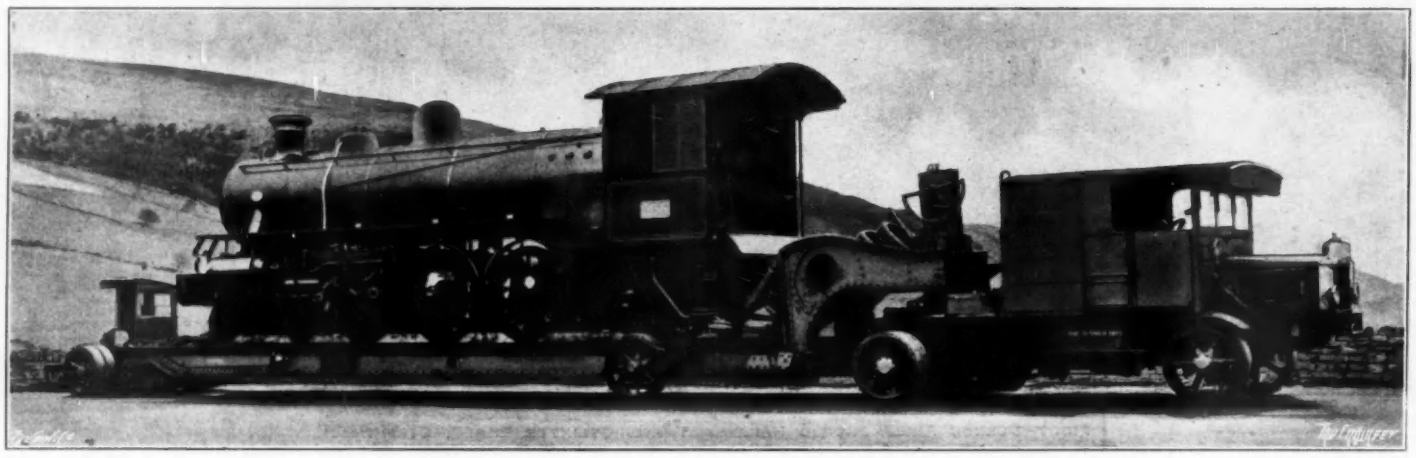


FIG. 10—ROAD HAULAGE OF A KITSON LOCOMOTIVE FOR THE SUDAN

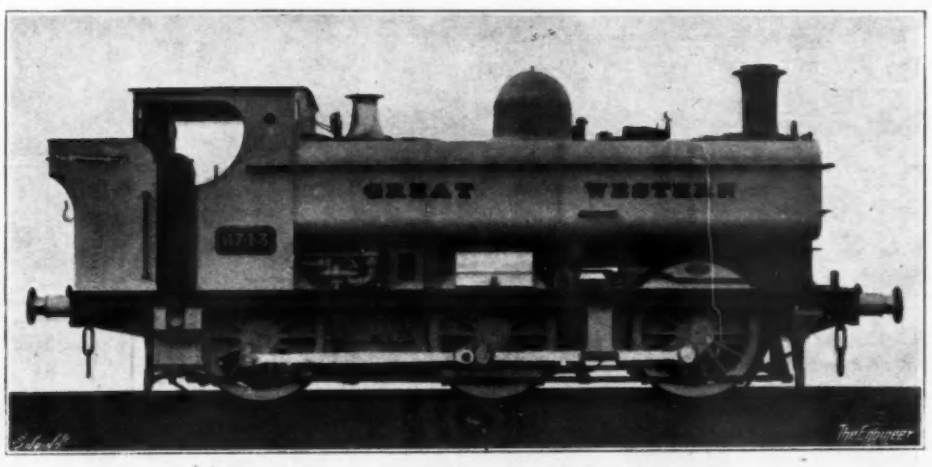


FIG. 11—PANNIER TANK ENGINE—YORKSHIRE ENGINE COMPANY

Makers' Engines.

If we have found little to say about companies' engines, there is not much more to be said about those —at 85 per cent.—is attained. A fuller account of these engines was given in our issue of October 24th.

This must be regarded as a quite notable undertaking, but we suggest that it is wrong, as some people have done, to consider it as hostile to the railways. As a railway proposition the load was impossible, but the engines could never have been built in Leeds had not the railways carried the raw material there. We might almost say that road transport on this scale is complementary to the railways, as, in a sense, it puts

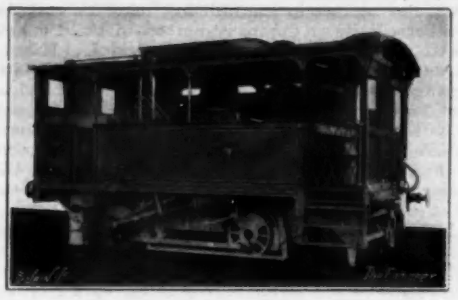


FIG. 12—BRAKE ENGINE—STEPHENSON

inland centres such as Leeds in direct touch with the ports, even for loads which no railway could accept.

Amongst other engines built by Kitsons during the year mention may be made of two for Jamaica, two metre gauge engines for the Malayan Collieries, Ltd., four side-tank engines for Mauritius, and three 4–6–0 engines for the through passenger service between Hong Kong and Canton. The last-named will haul 400 tons at 50 miles an hour and are said to be amongst the heaviest engines of their type in Southern China.

The principal work carried out by the Yorkshire Engine Company, Ltd., of Sheffield, was the construction of five and twenty pannier tank engines for the G.W.R. These locomotives weigh 47·5 tons in running order, carry 1200 gallons of water, have 4ft. 7½in. wheels, cylinders 17½in. by 24in., and can develop a tractive effort of 22,515 lb. with a boiler pressure of 200 lb. One of them is shown by Fig. 11.

Amongst the engines completed by Robert Stephenson and Co., Ltd., Darlington, twelve side tank locomotives for the Buenos Aires and Pacific Railway are the most notable. They have three 19in. by 26in. cylinders, 5ft. 7in. drivers, and exert a tractive force of 35,722 lb. at 85 per cent. of the boiler pressure, which is 200 lb. The tanks carry 3380 gallons of water. We illustrate these engines in Fig. 7. The firm also built two 0–4–0 brake engines to the order of the San Paulo (Brazilian) Railway Company for use on the new Serra inclines, one of which is shown by Fig. 12. Besides the locomotive proper, complete rope haulage gear, consisting of rope nipping box, rope lifting and lowering gear with toggles for gripping the rails are provided. Most of these operations are interlocked, and all are steam-operated by means of auxiliary steam cylinders.

We are glad to say that Stephensons have built another complete full-scale replica of the "Rocket." It is going to the Museum of the Peaceful Arts in New York and is partly in section. Taking it for all in all, the Darlington works were well employed throughout the year.

The North British Locomotive Company, Ltd., turned out many engines for foreign orders and of various classes. We have selected for illustration—see Fig. 14—a 4–6–2 locomotive for the Nanking Shanghai Railway. It has two 20½in. by 26in. cylinders, driving 5ft. 3in. wheels, and uses a boiler pressure of 200 lb. at 75 per cent. of which the tractive effort is 26,000 lb. In working order the engine weighs 90 tons 16 cwt. and the tender 71 tons.

Beyer, Peacock and Co., Ltd., of Manchester, gave, as usual, special attention to locomotives of the "Beyer-Garratt" type, of which sixteen were built for the Bengal-Nagpur Railway; fourteen for the Benguela Railway; three for the Peruvian Corporation, Ltd.; six for the South African Railway; three for the Argentine North-Eastern Railway, and thirty for the London, Midland and Scottish Railway. All these were repeat orders, but, as already mentioned, the last-named differs in some respects from its predecessors, and we illustrate it by Fig. 3. Of the group for the Bengal Nagpur Railway, three have Lentz rotary valve gear and three the Caprotti gear.

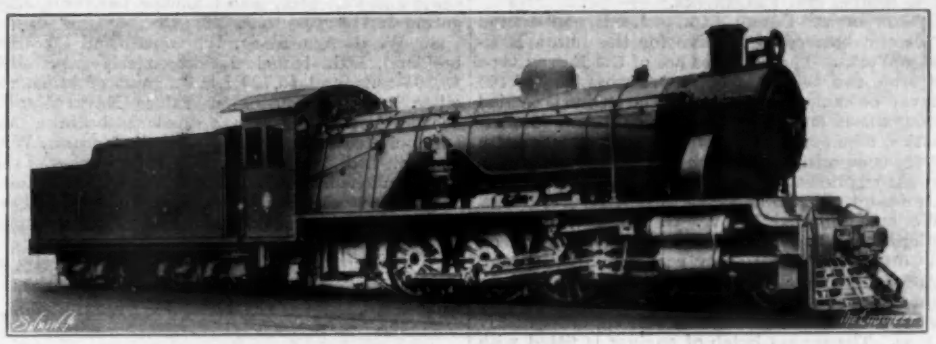


FIG. 14—NANKING-SHANGHAI RAILWAY—4-6-2 LOCOMOTIVE—NORTH BRITISH

In our issue of April 11th we described the most interesting engines completed by the Vulcan Locomotive Works during the year. They are two experimental locomotives for the N.W.R., India. They are very big machines with four 16in. by 26in. cylinders driving six-coupled wheels 6ft. 2in. in diameter. The heating surface is 2397 square feet, and the total weight of the engine and tender is 172 tons. A tractive effort of 26,420 lb. is developed at 90 per cent. of the boiler pressure, which is 220 lb. One of the engines has the inside cranks arranged in the usual way at 180 deg. to the outside pins, but in the other the angle is 135 deg., so that eight equal impulses are given. One engine has Caprotti and the other Lentz gear. We reproduce in Fig. 6 one of the illustrations from our article already mentioned. Quite a good number of other engines of various classes were constructed by the firm for overseas railways, but all to designs which are now almost standardised. One of them, for the Buenos Aires Great Southern, is to be shown at the Buenos Aires Exhibition this year.

John Fowler and Co. (Leeds), Ltd., Leeds, turned out several little engines for special services, two of which we illustrate in Figs. 13 and 15. The first is for use in the sisal fields of East Africa, and runs on a 2ft. gauge. It has cylinders 7½in. by 12in., and is fitted with a well tank between the frames, and side tanks. The wheels are 22in. in diameter and the wheel base only 4ft. The other illustration shows a locomotive fitted with an oil engine suitable for burning petrol, power alcohol, or paraffin, which develops about 50 H.P. The gauge is 3ft., the wheel diameter 27in., and the wheel base 6ft. A three-speed gear-box gives speeds of 3, 5, and 9 m.p.h., with reverse. The transmission is machine-cut spur gearing. A 70 H.P. high-compression oil engine locomotive for 4ft. 8½in. gauge, with 33in. wheels, was also constructed by the firm for various makers.

The Avonside Engine Company, Ltd., Fishponds, Bristol, has just completed the 2–8–0 locomotive with a double bogie tender which is illustrated by Fig. 16. This engine is for the metre gauge and has been constructed to the order of the Peruvian Corporation for the Guaqui La Paz Railway under the supervision of Messrs. Livesey, Son and Henderson, consulting engineers, of 14, South-place, London, E.C. 2. It has 16in. by 24in. cylinders, 3ft. 10in. drivers, and at 85 per cent. of the boiler pressure—180 lb.—exerts a tractive effort of 20,435 lb. It carries 1200 gallons of oil or 6 tons of coal and 3000 gallons of water. The total weight of engine and tender is 81 tons 14 cwt.

A fair number of locomotives was built by Sir W. G. Armstrong, Whitworth and Co. (Engineers), Ltd., during the year. An order for twenty 4–6–2 engines with double bogie tenders for the Central Argentine Railway, 5ft. 6in. gauge, is amongst the most notable. These engines, which are illustrated by Fig. 8, are

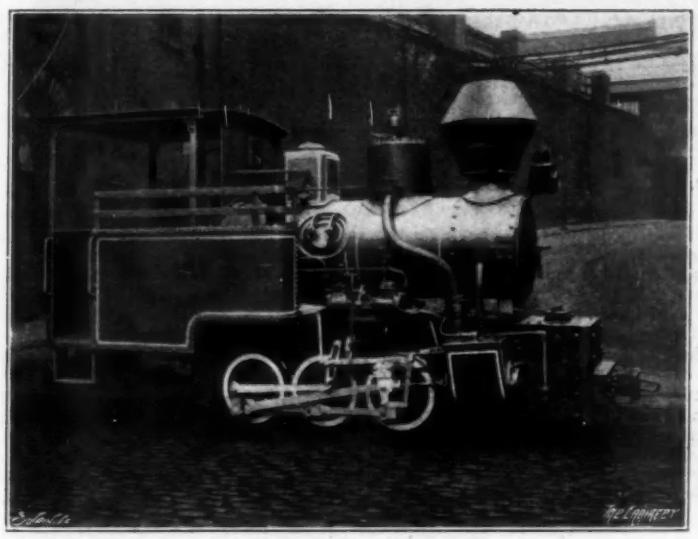


FIG. 13—ENGINE FOR SISAL FIELDS—FOWLER

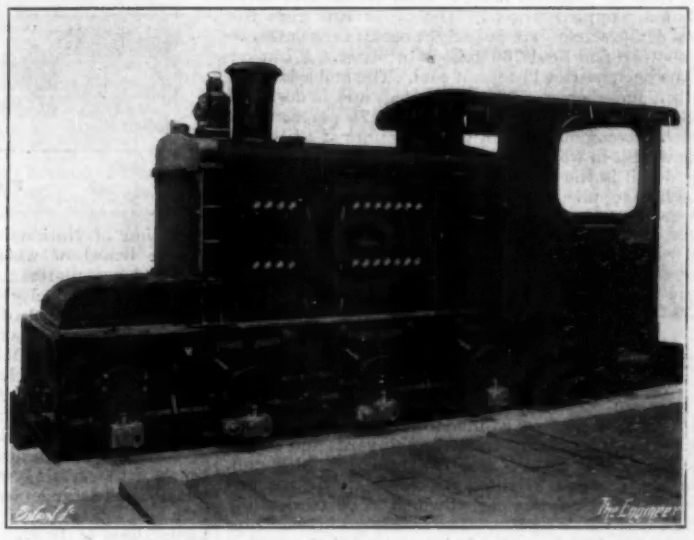


FIG. 15—MOTOR LOCOMOTIVE—FOWLER

FIG. 16—METRE GAUGE LOCOMOTIVE—AVONSIDE

fitted with Caprotti valve gear. They have three 19½in. by 26in. cylinders, driving 6ft. 2½in. wheels, with a working pressure of 225 lb. per square inch. The engines weigh in working order 97·1 tons and the tenders 72 tons. The firm also built half a dozen large engines for the Buenos Aires Great Western and a number of tank engines for at home and abroad.

During the year Nasmyth, Wilson and Co., Ltd., of Patricroft, near Manchester, built, amongst others, five 4–6–4 tank engines with Caprotti gear for the Federated Malay States Railway, metre gauge, and a number of tender engines of the same gauge for India, Kenya, and Tanganyika.

Greenwood and Batley, Ltd., of Leeds, constructed an electric battery locomotive for the Luton Electricity Works. The batteries are of the Edison type and drive two 40 H.P. motors. A gross load of 100 tons can be hauled on the level. The engine is carried on four wheels and the general design follows familiar practice, namely, an enclosed cab in the centre with battery compartments at each end. It is noteworthy that the engine was made and delivered in six weeks from receipt of the order.

We are informed by W. G. Bagnall, Ltd., of Stafford, that their works were mainly engaged on two orders of twenty-five each for panier-tank engines for the Great Western Railway. These engines are of the 0–6–0 type and have 17½in. by 24in. cylinders. They weigh in working order nearly 50 tons. The second batch of engines is fitted with the vacuum brake and with carriage heating apparatus. By the end of the year thirty of these locomotives had been delivered to Swindon. The firm also completed three side-tank engines for the Burma Corporation, Ltd., for use in the mines in Upper Burma. The line is very difficult, being composed of a succession of double reverse curves practically throughout its length, combined with numerous gradients of 1 in 25. The gauge is only 2ft. and the maximum axle loading is 9½ tons, and as the wheel arrangement is 2–6–2, the total adhesive load is 27¾ tons. The cylinders are, of course, outside; they are 13in. in diameter with a 16in. stroke and drive 2ft. 6in. coupled wheels. The tanks run from the level of the smoke-box door right back to the entrance to the cab and hold 760 gallons of water. A bunker at the back carries 1½ tons of coal. The boiler is fitted with a superheater of 94 square feet and is designed for a working pressure of 180 lb. at 75 per cent. of which the engine exerts a tractive effort of 12,168 lb. The weight in working order is 37½ tons. An interesting detail is the use of air sanding, the pressure for which is supplied by a Westinghouse pump fitted on the front of the right-hand tank.

Steamships and Steam Marine Engineering in 1930.

No. I.

IN spite of the industrial depression, 1930 may be looked upon as a moderately good year for launches. The returns from the shipyards and engine shops show in many cases high outputs, although, towards the end of the year, there was a marked decrease in the orders placed which will detrimentally affect this year's figures. The building of steamships and motor ships is so closely intermixed that one class of ship is difficult to separate from the other; but the beneficial effect of motor shipbuilding on the whole industry may be judged from our article on page 8. In the present year a difficult position must be faced.

Before passing to some of the more notable steamships of the year, it is of interest to record some of the principal returns. Belfast was a busy centre, and at Harland and Wolff's establishment 117,601 gross tons were launched, and 133,650 I.H.P. of engines completed. The former figure constitutes a record in tonnages for the port since the war. At the Clyde yards of Harland and Wolff, Ltd., the output was lower than last year, namely, 22,603 tons, with 49,340 I.H.P. for the Clyde engine works. After adding a total of 5432 tons for barges built in London, the total Harland and Wolff figures were 145,636 gross tons and 182,990 I.H.P., which make an increase over last year's returns. At the neighbouring yard of Workman, Clark and Co. (1928), Ltd., 54,880 tons were launched and 48,900 I.H.P. installed. These figures also show an increase on last year's returns.

The firm of Swan, Hunter and Wigham Richardson, Ltd., launched a total of 142,049 tons of shipping from its Tyne and Wear yards, and it completed 29,325 I.H.P. at the Neptune Engine Works. The total tonnage for the associated yards on the Clyde, Tyne and Wear amounted to 213,229 tons, which is the largest output so far recorded, and is 51,772 tons more than the figure for the previous year. The leading position on the Clyde was gained by Barclay, Curle and Co., Ltd., who launched ten ships, aggregating 64,714 gross tons.

Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., launched thirteen ships aggregating 88,395 tons, and 46,700 I.H.P., most of which were oil-engined tankers. The Walker Naval Yard of Vickers-Armstrongs was opened to begin a large turbo-electrically propelled liner for Furness, Withy and Co., Ltd., and at Barrow a large number of ships were launched and completed. At Cammell Laird's Birkenhead yard 61,257 tons were launched and 160,232 I.H.P. completed, both good figures, compared with last year's returns.

A beginning was made during the year, by the formation of National Shipbuilders' Security, Ltd., on the board of which the principal shipbuilding interests are represented, to reduce the redundant shipbuilding capacity in various centres. On the Clyde, the shipyard of William Beardmore and Co., Ltd., at Dalmuir, was closed; also that of Napier and Miller, Ltd., at Old Kilpatrick, while other yards which were also purchased and closed down included the South Yard of the Ardrossan Dockyard Company, Ltd., and the business of John Chambers and Co., Ltd., of Lowestoft. It is understood that the board of National Shipbuilders' Security, Ltd., is also in touch with certain yards on the North-East Coast, but no final arrangements have been so far made.

Large Liners of 1930.

The outstanding event of 1930 was the decision of the directors of the Cunard Steamship Company, Ltd., to entrust to John Brown and Co., Ltd., Clydebank, the building of a new express liner for Atlantic service, the keel plates of which were laid before the end of last year. From various official statements, we are able to record that the length of the new liner will be about 1018ft., with a measurement of 75,000 gross tons, and a capacity of 7,300,000 cubic feet.

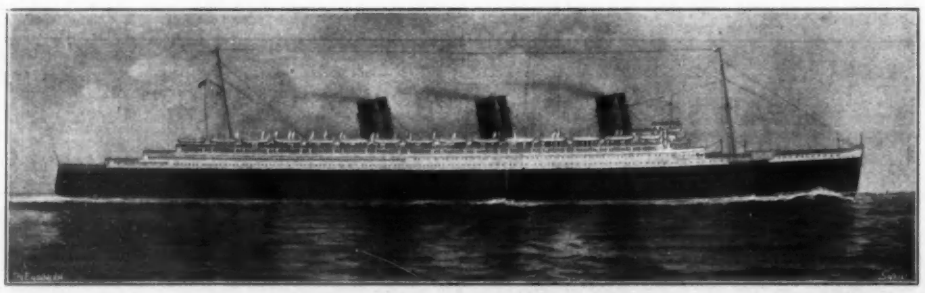


FIG. 1—PROSPECTIVE VIEW OF NEW CUNARDER

The propelling machinery will comprise a quadruple-screw arrangement of Parsons single-reduction geared turbines, with the latest auxiliary machinery, and steam will be raised in a large installation of high-pressure water-tube boilers of the Yarrow type. The boilers will be built by John Brown and Co., Ltd., to the special designs of Yarrow and Co., Ltd. No official figures have been given with regard to the speed of the ship or her designed machinery output. Speeds up to 30 knots have been mentioned, and if we are to judge from recent Atlantic liner practice, it would seem that an estimated power of 180,000 to 200,000 S.H.P. for the turbines would not be far wrong. Great care is being taken by the builders and the technical staff of the Cunard Company to incorporate in the design such features as will make the ship worthy of all that is best in British shipbuilding and marine engineering practice. Special facilities were granted by the Government to cover the construction and marine insurance risks which could not be met in the ordinary markets, and the Southern Railway Company agreed to build a new graving dock at Southampton with a length of 1200ft., an entrance width of 135ft., and a depth of 48ft. Arrangements were also made by the Clyde Navigation Trust to widen and deepen the Clyde channel, so as to ensure the safe launching of the liner and its safe passage to the Firth of Clyde when completed. In Fig. 1 we reproduce an official picture from the Cunard Company showing how the liner will appear when she has been completed.

In a Supplement to-day we reproduce a view of the North German Lloyd liner "Europa," which was built and engined by Blohm and Voss, of Hamburg, and entered the Atlantic service in the spring of last year. On Tuesday, March 25th, on her maiden voyage from Bremerhaven to New York, the "Europa" set up a new record for the Atlantic crossing, making the voyage between Cherbourg and the Ambrose Light Vessel in 4 days 17 hours and 6 minutes, with an average speed of 27·91 knots. The "Europa" now shares with her sister liner the "Bremen," the honour of the Blue Ribbon of the Atlantic. The boilers and turbine machinery have operated with great satisfaction to both owners and builders.

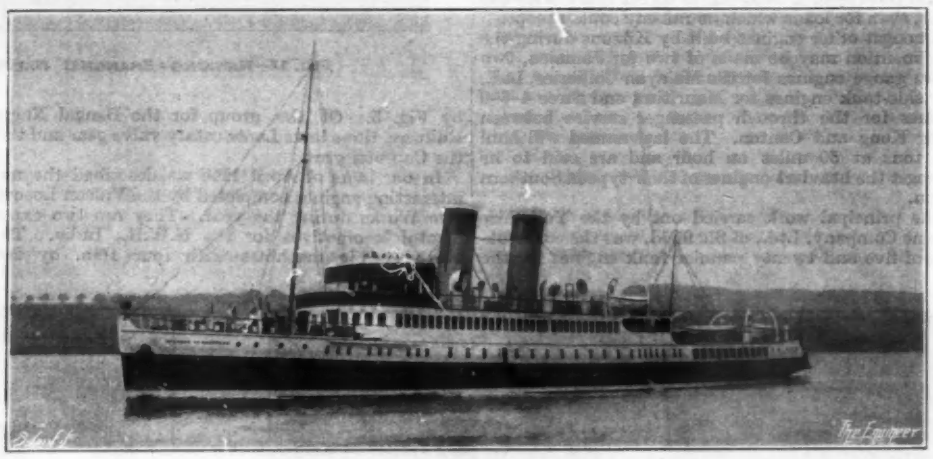


FIG. 2—L. M. & S. CLYDE STEAMER "DUCHESS OF MONTROSE"

The largest British liner of the year was the Canadian Pacific liner "Empress of Britain," which was launched and named by the Prince of Wales on June 11th last at John Brown and Co.'s Clydebank yard. The ship has a length of 758ft., with a beam of 97ft. 6in., and a loaded draught of 32ft., her measurement being 42,500 gross tons. She has been specially designed for her owners' Southampton, Cherbourg, and Quebec service, and will have a sea speed of 24 knots. Her propelling machinery comprises a special arrangement of quadruple-screw single-reduction, geared Parsons turbines, with nine water-tube boilers, designed for a working pressure of 425 lb. per square inch and 700 deg. Fah. total superheated steam temperature. Good progress has been made with the engining and fitting out of this ship, and she is expected to be completed in the early summer of this year. At the Govan yard of the Fairfield Shipbuilding and Engineering Company, Ltd., the Canadian Pacific liner "Empress of Japan" was completed, and a full record of her will be found in our issues of August 15th and 22nd last. A view of this handsome ship is given in to-day's Supplement. She has a length of 666ft., with a moulded breadth at the promenade deck of 87ft. 9in., and a moulded breadth to the bridge deck of 56ft. 9in. Her measurement is 26,032 tons, and she is propelled by twin-screw single-reduction geared turbines of 30,000 S.H.P., corresponding to a service speed of 21 knots. The boilers consist of six high-pressure Yarrow water-tube units and two cylindrical boilers. The water-tube boiler pressure is 425 lb. per square inch, with 725 deg. Fah. total steam temperature. A very complete auxiliary electrical installation is provided, comprising four 300 kW oil engine driven generator sets and two 600-kW turbo-generator sets. After successful trials, the "Empress of Japan" made one complete Atlantic voyage before leaving Southampton to take up her service in the Pacific Ocean. Her net steaming time from Southampton to Hong Kong on the outward voyage to the Pacific was 18 days 19 hours, at an average speed of 21 knots. In the autumn of last year she completed a trans-Pacific voyage in a little over eight days, at an average speed of 21·05 knots, thus creating a new record. Her fuel consumption for all purposes was 0·60 lb. per S.H.P. hour, and she has registered fuel coefficients of the order of 56,000, representing an advance of

12 per cent. over the best performance of the C.P.R. "Duchess" class liners. The fleet of "Duchess" liners has continued to operate with great success and high economy, and it has now been shown that it is quite safe and practicable to steam the boilers of these ships for a period of six months without examination. Even at the end of such a period only a nominal amount of brushing is needed. The fast C.P.R. cargo liners of the "Beaver" class continued to operate without a hitch of any kind, and it has now been decided to equip the hand-fired Babcock boilers of two of the ships with automatic stokers of the Erith-Roe and Taylor types. Coal crushers will also be added to the equipment of each ship, so that any grade of coal from "smalls" to "run of mine" can be used as required.

Electrically-propelled Ships.

The P. and O. liner "Viceroy of India" continued to give excellent service, and as a result of the good experience with the turbo-electric propelling machinery on that ship it was decided by the directors of the P. and O. Company to proceed with two further ships of the electrically-propelled type. The order was placed with Vickers-Armstrongs, Ltd., of Barrow-in-Furness, and the main propelling and auxiliary electrical machinery is being constructed by the British Thomson-Houston Company, Ltd., of Rugby. The main turbo-alternator sets, of which there are

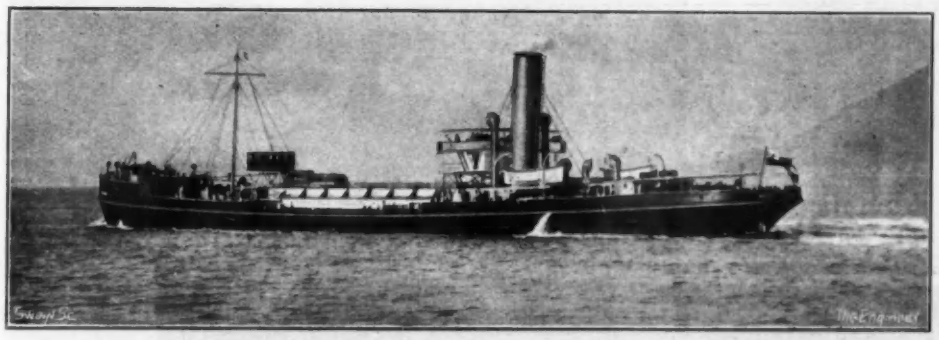


FIG. 3—SUCTION-HOPPER DREDGER "REITBOK"

two for each ship, each have a rating of 10,700 kW at 2900 r.p.m., with steam conditions of 375 lb. per square inch gauge, 283 deg. Fah. superheat, 28in. vacuum, and the boilers are of the latest Yarrow water-tube type. Generating plant for each ship comprises three 750-kW units of the combined condenser and turbine type, and a 400-kW harbour unit. These sets are to work with steam at full boiler pressure.

A ship for the Union Steamship Company of New Zealand has also been begun at the Vickers-Armstrongs' Barrow-in-Furness yard. The two main generating units for this ship each has a maximum output of 5000 kW, when supplied with steam at 400 lb. per square inch gauge and 277 deg. Fah. superheat and 28½in. vacuum. The auxiliary generating sets, of which three are provided, are also of the combined condenser and turbine type, and have a normal rating of 350 kW at full boiler pressure.

The ship is designed to ply between Wellington and Lyttleton, and she will normally run a night service at 17 knots, but in the holiday season of about eight days in the year she is designed to do the double run in twenty-four hours at 20 knots. The machinery is so arranged that the normal service will be carried out with one turbo-alternator driving the two propeller motors, while for the higher speed both turbo-alternators will be brought into service.

Other turbo-electrically propelled ships put into service during the year included two fruit carriers for Elders and Fyffes, Ltd.—the "Musa," built by Workman, Clark (1928), Ltd., and the "Platano," constructed by Cammell Laird, Ltd., of Birkenhead. They are single-screw vessels and are provided with B.T.H. turbo-electric propulsion machinery, designed to give a service speed of 16 knots. Each installation comprises a 5500-kW, turbo-alternator running at a normal speed of 3000 r.p.m., which drives a 7000 S.H.P., 125 r.p.m., 2600-volt, three-phase propeller motor. The auxiliary load is very heavy, and the auxiliary machinery for each vessel consists of two B.T.H. turbine-driven D.C. generators of 500-kW, 220 volts rating, and one of 175 kW. A view of the "Platano" is given in to-day's Supplement.

At Belfast, Workman, Clark (1928), Ltd., re-engined the fruit-carrying ship "La Marea," and reconstructed the entire centre part of the ship, removing the oil engine driven generators and installing B.T.H. turbo-electric propelling machinery suitable for a speed of 14½ knots. Steam is raised in two Babcock-Wilcox oil fuel marine type boilers, with a working pressure of 370 lb. per square inch and 264 deg. Fah. superheat. There is one 2700-kW turbo-alternator set, supplying three-phase 1200-volt current to an enclosed synchronous propelling motor designed for an output of 3300 S.H.P. at 120 r.p.m. After re-engining, the vessel was re-named the "Darien."

A Large Whaling Factory Steamer.

An outstanding ship of the year was the twin-screw whaling factory steamer "Tafelberg," a view of which is reproduced in to-day's Supplement. She was built at the Walker shipyard of Sir W. G. Armstrong, Whitworth and Co. (Shipbuilders), Ltd., for the Kergulen Sealing and Whaling Company, Ltd., of Cape Town, South Africa. The hull of the ship is specially strengthened for working in ice and has a length of 520ft. with a moulded breadth of 72ft. The "Tafelberg" is designed to carry about 16,300 tons deadweight on a mean draught of 30ft. Her propelling machinery comprises a twin-screw arrangement of modern triple-expansion steam engines, and superheated steam is generated in five single-ended, oil-fired boilers working under forced draught and designed for a working pressure of 200 lb. per square inch. The "Tafelberg" carried out most successful trials before leaving for South Africa, and she was finished a few days before the contract time. The Newcastle firm of Arensen Christensen and Smith, Ltd., naval architects and consulting engineers, supervised her construction.

Some Coastal and Cross-Channel Steamers.

The fast coastal vessel "Princess Helene," which is illustrated on page 24, is of interest on account of her being the first ship to go to sea with a Johnson type water-tube boiler. She was specially designed for the Canadian Pacific Railway Company's Bay of Fundy ferry service, between St. John, New Brunswick, and Digby, Nova Scotia. She has a

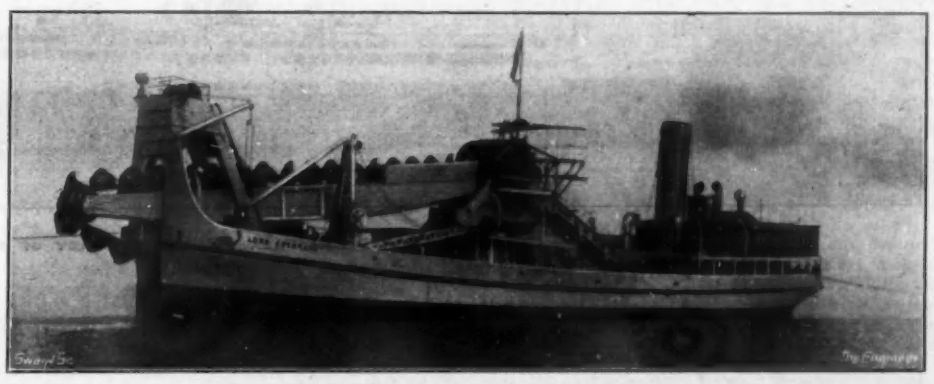


FIG. 4—BUCKET-HOPPER DREDGER "LORD COCHRANE"

Early in the year the Fairfield Shipbuilding and Engineering Company, Ltd., delivered two coastal steamers for the C.P.R. Vancouver service. They were named the "Princess Elizabeth" and "Princess Joan," and are 5000 gross ton ships with a length of 365ft., a beam of 52ft. and a depth of 36ft. The propelling machinery consists of twin-screw quadruple expansion balanced engines, working at 250 lb. per square inch, steam being raised in four Scotch single-ended boilers.

During the year three fast turbine steamers were built and engined by Cammell Laird and Co., Ltd., for Canadian National Steamships, of Montreal. They are for service on the Vancouver and Alaska coasts, and are named the "Prince Henry," the "Prince Robert," and the "Prince David" respectively. A view of the "Prince Henry" is reproduced opposite. The propelling machinery was constructed by the builders, and consists of twin single-reduction geared Parsons turbines, supplied with steam at 350 lb. pressure and 650 deg Fah. total temperature from six Yarrow type water-tube boilers. Two Scotch boilers are used for auxiliary and heating steam. These ships were built under the supervision of Messrs. A. T. Wall and Co., naval architects and consulting engineers, of Liverpool.

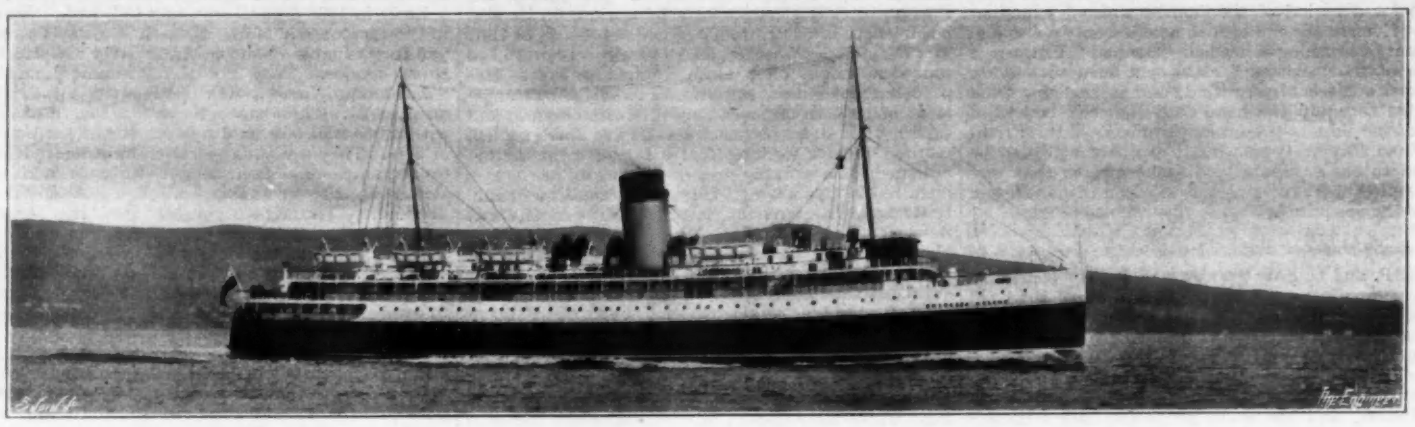
Early in 1930 John Brown and Co., Ltd., delivered to the London and North-Eastern Railway Company two further cross-Channel steamers for the Harwich Hook service. They are the "Prague" and the "Amsterdam," and a view of the latter ship is given on page 24. These steamers have a length of 350ft. with a beam of 50ft. and a depth to the shelter deck of 27ft. They are equipped with twin-screw Brown-Curtis single-reduction geared turbines and have electrically driven auxiliaries. The trial speed was 21½ knots. Throughout the year these new steamers were greatly appreciated by travellers using the Harwich route to the Continent. Four new turbine steamers were built for the Belgian Railway Company's service between Ostend and Dover, and the first ships have already been commissioned. They are 360ft. long with a beam of 48ft. and the propelling machinery consists of single-reduction geared turbines, steam being raised in oil-fired Babcock and Wilcox boilers designed for a working pressure of 390 lb. per square inch and a total superheated temperature of 600 deg. Fah. The names of the ships are the "Princess Astrid," the "Prince Leopold," the "Prince Charles," and the "Princess Josephine Charlotte."

A noteworthy ship of the year was the Isle of Man Steam Packet Company's new steamer the "Lady of Mann," which was built and engined by Vickers-Armstrongs, Ltd., at Barrow-in-Furness. A view of this new steamer is reproduced opposite. She is a 22-knot twin-screw geared turbine-driven ship, 373ft. in length with a measurement of about 3100 gross tons. During the official trials a speed of 23 knots was attained. Last year the Isle of Man Steam Packet Company celebrated its centenary. An interesting type of excursion steamer, specially designed for the L.M.S. service on the Firth of Forth, is the "Duchess of Montrose," illustrated in Fig. 2. She was built and engined by William Denny and Brothers, at Dumbarton, and is a one-class ship, specially arranged for river and estuary service and for excursions and cruises. Her principal dimensions are: Length, 260ft.; breadth, 32ft., and depth, 18ft. 1in. The passenger accommodation is luxurious, and a new feature of the design is the large enclosed deck shelter on the promenade deck. The "Duchess of Montrose" is propelled by three independent Parsons compound turbines, each of which is coupled to its own propeller shaft, and steam is raised in a large coal-fired double-ended cylindrical boiler constructed for a working pressure of 180 lb. per square inch. Messrs. Denny's also completed shortly before the end of the year the turbine steamer "Slieve Bloom" for the Holyhead-Dublin service of the L.M.S. Railway. She is a special twin-screw, high-speed vessel with a length of 310ft., a beam of 44ft. 6in. and 15ft. 6in. moulded depth to the main deck. She is designed to carry about 750 tons deadweight on a 13ft. draught. Special arrangements are made for transporting cattle, and provision for about 620 head of cattle is available, while temporary accommodation for a further 250 horses can be easily made. She has a twin-screw arrangement of single-reduction Parsons turbines, and steam is generated by two 225 lb. pressure Babcock and Wilcox water-tube boilers, working in a closed stokehold under forced draught.

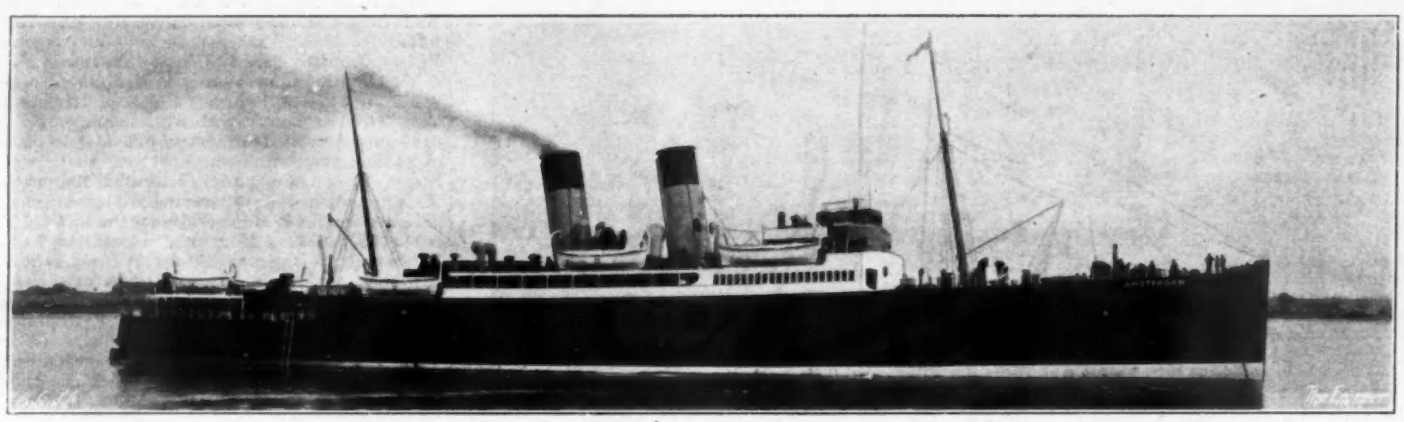
Some Dredgers of 1930.

An interesting hopper suction dredger of 1930 was the "Reitbok," built by William Simons and Co., Ltd., of Renfrew, for the South African Railways and Harbour Administration. A view of the dredger is given in Fig. 3. Her duty will be to maintain and increase the depth of water over the open sea bar outside Durban harbour, where heavy weather is frequently experienced. The "Reitbok" is one of the largest dredgers yet constructed, and her hopper capacity is 100,000 cubic feet with the hopper arranged amidships, and the suction pipe well and pumping machinery forward and the boilers and propelling machinery aft. In order to permit dredging

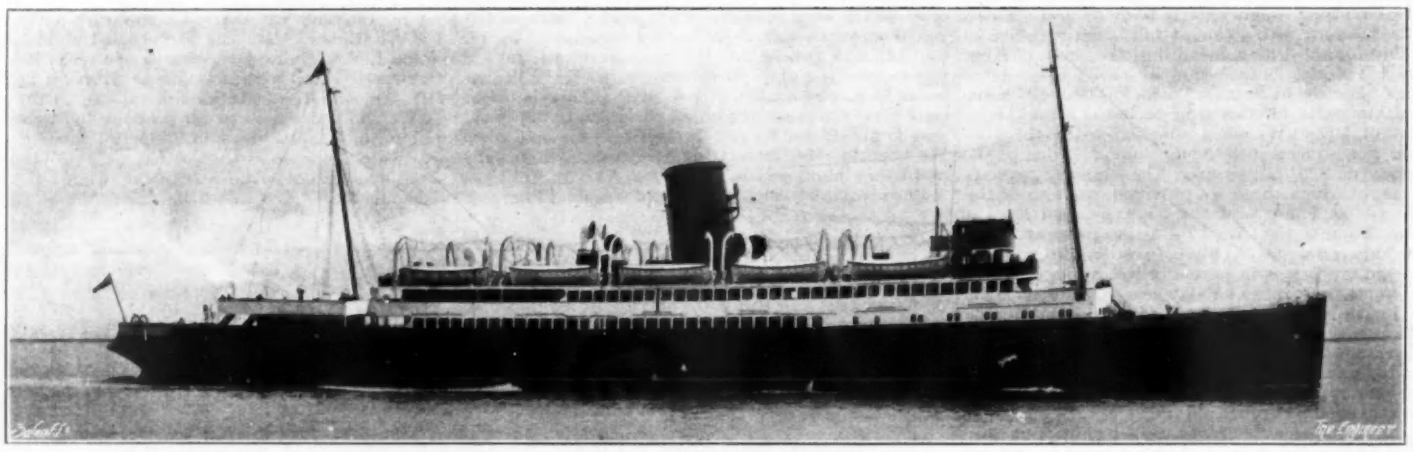
SOME CROSS-CHANNEL AND COASTAL STEAMERS OF 1930



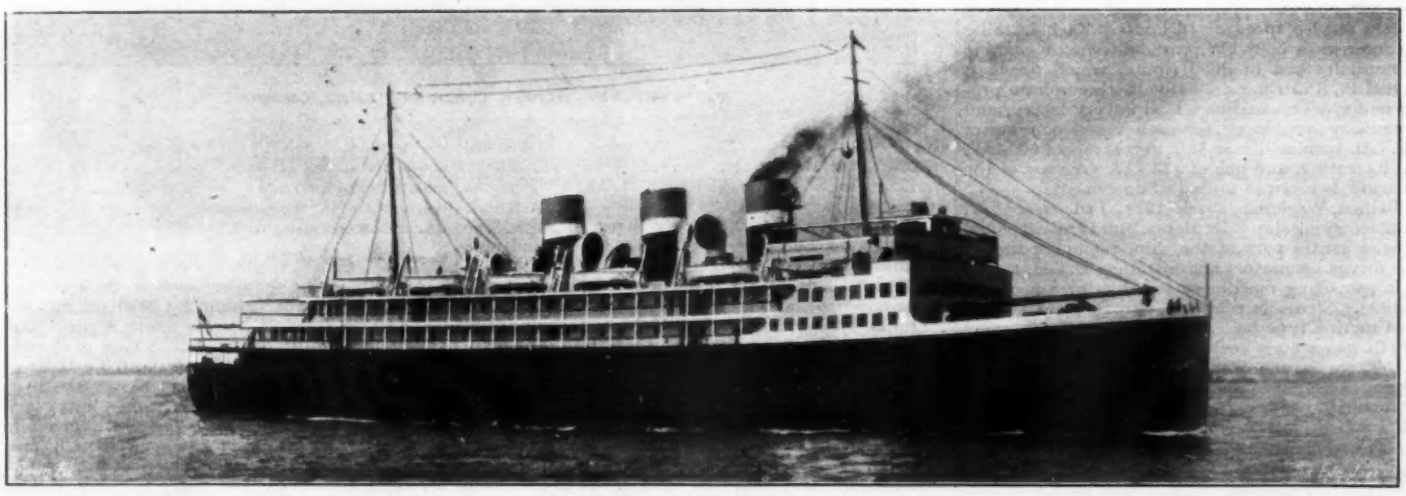
CANADIAN PACIFIC RAILWAY STEAMER "PRINCESS HELENE"



L.N.E.R.—HARWICH-HOOK CROSS-CHANNEL STEAMER "AMSTERDAM"



ISLE OF MAN STEAM PACKET STEAMER "LADY OF MANN"



CANADIAN NATIONAL RAILWAY STEAMER "PRINCE HENRY"

HUDSON RIVER BRIDGE—VIEWS SHOWING CONDITION ON DECEMBER 10, 1930

LOOKING TOWARDS MANHATTAN APPROACH.

LOOKING TOWARDS NEW JERSEY SHORE

operations to be continued in rough weather, the suction pipe is in two portions connected with a universal joint, so that the nozzle remains on the ground, even when the vessel is tossing and pitching. The hopper doors are closed by hydraulic gear, supplied by MacTaggart, Scott and Co., Ltd., of Edinburgh, and the suction pump is of the builder's special design and is driven by a triple-expansion engine. The boilers, four in number, were constructed by the builders, and they are designed to burn Natal coal on an assisted draught steam jet principle, fitted by Turbine Furnaces, Ltd., of London. The propelling engines are of the triple-expansion type, driving twin screws. Very complete deck machinery is provided, and there is good accommodation for officers and crew. Before leaving for South Africa, the "Reitbok" steamed some 500 miles on her official trials, and loaded her hopper with over 5000 tons of sand in 60 minutes. The speed in the loaded condition was 11½ knots, or half a knot in excess of the contract requirements. The "Reitbok" has a measurement of 4538 gross tons, and her machinery is 5300 I.H.P. Three smaller dredgers and a large 1233-ton pontoon, together with a small pontoon and a large quantity of dredging machinery, were supplied by Wm. Simons and Co., Ltd., during the year.

At the end of November, Ferguson Brothers (Port-Glasgow), Ltd., launched with steam up the completed bucket hopper dredger "Lord Cochrane," a view of which we give in Fig. 4. This dredger was built to the designs and under the supervision of Messrs. Coode, Wilson, Mitchell and Vaughan-Lee, of London, to the order of the Crown Agents of the Colonies for service in Bermuda, and will be principally employed in dredging rock. For this reason the dredger is very robustly constructed, and a special 8-ton boulder steam crane is fitted on the port deck, with a boulder dump adjacent to it. The "Lord Cochrane" has a length of 215ft., with a beam of 41ft. and a moulded depth of 16ft. 6in., and the overall length over the dredging ladder is 245ft. The propelling and dredging machinery was constructed by the builders and includes many of their specially patented devices. The engines are triple-expansion, twin-screw units, arranged for coupling either to the propellers or the dredging machinery. There are two oil-fired marine boilers, with adaptable furnace fronts for burning coal if desired. Several other dredgers, pontoon and tugs were also completed by Ferguson Brothers.

(To be continued.)

Bridges in 1930.

A good deal of bridge-building went on during the year, and two structures, one in the United States and the other in Australia—which resemble one another closely in several respects—advanced to the stage of having their arches closed. The bridges in question are: (*a*) the Kill Van Kull Bridge, between Bayonne, N.J., and Port Richmond, Staten Island, N.Y., and (*b*) the Sydney Harbour Bridge. A photograph of the latter, taken just before the arch was closed, is reproduced in one of our Supplements to-day. These two bridges, which are within 2ft. of being equal in length—the American structure measuring 1652ft. and the Australian 1650ft.—are by far the longest single span arch bridges in the world. In all other respects than length, however, the Sydney bridge has the advantage. It gives, for instance, a clearance for shipping of 172ft. 6in., as compared with 150ft.; and it contains more than twice the weight of metal—37,000 tons, as against 16,000 tons. It provides a roadway 56ft. wide, with two footways 10ft. wide and width enough for four lines of electric railways, whereas its rival has a roadway only 40ft. wide, with two 6ft. 6in. footways and width enough for two lines of railway. Moreover, the Sydney Bridge has a rise of 350ft. between pins and the New York structure a rise of only 266ft. between pins. There is, in addition, considerable divergence between the abutments of the two structures. At Sydney they measure 224ft. wide and 161ft. long, while those of the Kill van Kull Bridge measure 133ft. 6in. wide and 107ft. 6in. long. There was still greater dissimilarity in the times taken to erect the arches. That in America was begun in November, 1929, and closed on October 4th, 1930, whereas that of the Sydney bridge was begun in January, 1925, and closed on August 18th, 1930. Nor were the methods of erection employed the same. At New York the bridge was erected on the cantilever method from false work, and the actual closing took place 250ft. from the centre of the arch. For the largest bridge of this type previously erected false work had not been used, and the reason for closing 250ft. from the centre was that no false work was allowed in the ship channel. At Sydney the erection was carried out by specially designed gantries, bearing cranes, which were described in our issue of October 28th, 1927, and which, as the work proceeded, travelled on rails on the two arms, the latter being anchored to the shore by cables.

Another bridge on the American Continent, that which crosses the river St. Lawrence at Montreal, was completed during the year. It was described in our issues of June 20th and 27th last, and a view of it is reproduced in our Supplement. It comprises two systems of cantilevers giving a free opening of well over 1000ft. in the centre and a headroom clearance at high water of 163ft. The total length with its two approaches is considerably over 11,000ft. The main span of the bridge is a symmetrical cantilever, having an overall length of 1937ft., the centre span measuring 1097ft. from centre to centre of the main piers. The trusses of the anchor and cantilever arms are of the "K" design, and are spaced at 66ft. 6in. centres. They are 162ft. deep at the main piers, reducing to 54ft. at the centre of the span. The suspended span is 378ft. 6in. long.

Work was continued on still another important bridge—that over the Hudson River to the north of Manhattan Island, New York. We have given *résumés* of the progress reports on this bridge for the last three years, the Third Report having been dealt with in our issue of August 1st last. It is a suspension bridge, with a span of no less than 3500ft. between the centres of the cable supporting towers, which are 635ft. above water level, a total length between anchorages of 4800ft., and a total length with approaches of 7800ft. The headroom clearance at the centre of the span is 213ft. The span is supported by four cables in two pairs, each pair arranged at 9ft. centres, apart, the distance between the two pairs of cables being 106ft. It is to be a double-deck bridge, the upper deck giving accommodation for no less than eight lines of roadway traffic and two footways, while on the lower deck there will be two sets of two railway tracks. The total weight of the suspended super-structure, when completed, will be 90,000 tons, and the strength of the carrying cables is 350,000 tons. Photographs taken on December 10th last, which are reproduced herewith, show that the main cables were completed, compressed and bound, that the hanging cables were in position, and that the erection of the decking of the bridge was well advanced.

Another bridge of an entirely different and very striking character was completed and formally opened in August last. It is the Albert Louppe Bridge over the river Elorn at Plougastel, near Brest. It is a reinforced concrete structure with three main spans, each of 186·4 m., or, say, 611ft. 6in., centres to centres, giving a clear opening of 172·6 m. The headway clearance in the central arch is 139ft. 6in. The deck

of the bridge is carried on the tops of the arches and on spandril piers, also founded on the upper faces of the arches, and the two approaches are carried on concrete piers. The three main arches were constructed on specially-built timber centering carried on lighters, which was used for all three arches, being floated away from under each in turn, when the concrete of the arch was sufficiently strong. A double cableway spanning the river was used for placing the concrete. The deck is in two floors, the upper of which provides a roadway 6·0 m. wide, with a footway 1·0 m. wide on each side of it, while the lower deck supports a single line of standard gauge railway.

Still another bridge, again of a character entirely different from any of the foregoing, was formally opened during the year by His Royal Highness the Prince of Wales. It is the new opening-span Haven Bridge at Great Yarmouth, and a view of it, with the two leaves raised, is reproduced in one of our Supplements. It was described at some length in our issue of November 21st last, and we need not, therefore, describe it fully in the present instance. We may say, however, that the new structure, which superseded a bridge with an opening span of 50ft., built 75 years or so ago, is 230ft. between abutments. The central opening provided for navigation is 90ft. in width. The bridge provides a roadway 42ft. wide, with a footway 10ft. wide on each side of it. It was originally intended to run tramways across it, which accounts for the unusual width of the roadway; but the idea was abandoned. The extra width is, however, of great advantage in these days of increasing vehicular traffic, especially in view of the fact that there is no other means of crossing the Yare, which it spans, nearer than Norwich, some 20 miles away. It may be added that the time occupied in opening the navigation span is one minute, while the time taken to close it is two minutes.

Exhibition of British Chemical Plant.

REPRESENTATIVE exhibitions of British chemical plant are of infrequent occurrence. Though the last one, held in 1926 in conjunction with the London meeting of the Society of Chemical Industry, was very successful, a favourable opportunity for repeating this venture has so far not occurred. Consequently, the capabilities of the British chemical plant industry have not been publicly demonstrated or appreciated as have those of German chemical plant manufacturers, who have derived wide publicity and great benefit from the Achema, which is held every second or third year. A unique opportunity for remedying this state of affairs and for bringing British chemical plant to the notice of the chemical and allied industries throughout the world will occur next July on the occasion of the Jubilee Celebrations of the Society of Chemical Industry. The British Chemical Plant Manufacturers' Association has decided, in co-operation with the Chemical Engineering Group of the Society, to stage an exhibition which will be open during the whole week of the Celebrations, from July 13th to 18th inclusive. The Central Hall, Westminster, has been selected for the purpose, in view of its convenient position, and the exhibiting area will be twice as great as in 1926.

The Exhibition will cover all types of plant, apparatus, instruments, constructional materials and general equipment required by the chemical industry and the numerous other branches of industrial activity associated with it. Only makers of British plant will be eligible to exhibit. There will be a section devoted to the work of the various research associations and to the Department of Scientific and Industrial Research. This will be organised on non-trade lines by the Chemical Engineering Group of the Society of Chemical Industry, and its object will be to demonstrate the important part which science plays in the development of British industry and in the control of the products.

Admission to the Exhibition will be free, and invitations will be widely distributed to those who are interested in British chemical plant. The public will also be admitted free on the Friday afternoon and the Saturday. Special steps will be taken to ensure the production of a fully classified catalogue to assist the visitor, and this will be supplied free, either on admission or an application to the British Chemical Plant Manufacturers' Association. Would-be exhibitors may be interested to know that a very comprehensive scheme of publicity is to be arranged to ensure that the Exhibition is brought to the notice of interested parties, both at home and abroad. The opening ceremony will be performed by the President of the Society of Chemical Industry, or some other important person, and will be associated with a special Press view and a luncheon.

The regulations and instructions to exhibitors are now ready, and while copies have been distributed to a large number of firms making chemical equipment, it is possible that some may have been overlooked. These are requested to make application to the office of the British Chemical Plant Manufacturers' Association, 166, Piccadilly, London, W. 1, from which further information may be obtained at any time. Further announcements will be made between now and the opening, to show the progress which is being made.

THE North of England Institute of Mining and Mechanical Engineers has received from the Wallsend and Hebburn Coal Company, Ltd., twelve volumes of the manuscripts and notes of George Johnson, the colliery viewer who surveyed coal areas in Northumberland and Durham from 1717. Mr. R. S. Anderson, President of the Institute, has renewed his appeal to the public for such documents.

Canadian Engineering News.

Natural Gas Developments.

A NEW proposition has been added to the proposals to furnish the city of Regina, Saskatchewan, with a supply of natural gas, the latest offer coming from Turner Valley independent oil and gas operators, who declare their ability at the present time to deliver in Saskatchewan more than 150,000,000 cubic feet of gas per day. The operators forming the pool declare that it is a demonstrable fact that they can procure 25,000,000 dollars, or as much more money as may be required, for the laying of a pipe line and all other incidentals. The proposal was outlined to the Regina City Council by Colonel C. E. Gregory, K.C., of Regina, who stated that he represented a pool in which 24 out of approximately 40 independent gas and oil operators in the Turner Valley field were now joined. This new pool would be willing to pipe gas to Regina and distribute it or to sell it to the city at the city limits for distribution by the municipality. The pool was also prepared to go into a partnership with the city on the proposition. The present position, therefore, is that Regina has four offers of a natural gas supply.

British Capital in Oilfields.

Five million dollars of British capital, organised under the name of Anglo-Western Oils, Ltd., with a Dominion charter, has entered the Alberta oilfields and the company will drill immediately in the Milk River area, in which it proposes to sink two wells.

Gold Output Stepped Up.

Lake Shore Mines, Ltd., Kirkland Lake gold property, is about to reap the benefit of a 2,000,000 dollars expansion programme. Mill tonnage is being raised to 2000 tons, or more, per day, compared with the old capacity of 1350 tons. The expansion programme comes in for attention in the annual report of the company, covering the twelve months ended June 30th, 1930. The main items in the construction programme are:—Underground, new crushers, electric locomotives, &c.; surface, mill, crusher house, refinery, shaft house, power-house equipment, shops, office and dwellings, as well as railway sidings and electric shovels for sand backfill. Lake Shore mines produced bullion to the value of 6,567,780 dollars in the 1930 fiscal period compared with 5,504,858 dollars in 1929, and 3,629,317 dollars in 1928. Total production from the beginning of the mine to the end of the 1930 period was 25,883,673 dollars. The report shows that 467,648 tons of ore were treated during the year. This compares with 367,015 tons in the preceding year, showing an increase in ore handled of 100,633 tons. Since the 1926 fiscal period the amount of ore handled per year has nearly quadrupled, while the bullion recovery has almost trebled.

Transmission Line in Manitoba.

The Northwestern Power Company has entered into a contract for the construction of a 1,000,000-dollar double-circuit, steel tower electric transmission line from its Seven Sisters Falls power development on the Winnipeg River, in Manitoba, to the city of Winnipeg. The new line will be 63 miles long and will transmit power at 110,000 volts. It will be built by the Canadian Engineering and Construction Company, and is to be completed by next August. Eventually, a second line is to be erected on the same right-of-way at an additional estimated cost of 750,000 dollars.

Pole-treating Plant.

A new wood pole open vat treating plant was recently completed at St. Lambert, Quebec, by the J. J. Seguin Company, Ltd., of Montreal. The equipment consists of three open vats for butt treatment of about 12ft. by 18ft. each. These vats have a capacity of four car-loads and the plant a capacity of about eight car-loads per day. Treatment is from four to twenty hours, according to specifications and the nature of the wood. In the hot treatment the temperature varies from 180 deg. to 225 deg., and in the cold treatment from 120 deg. to a maximum of 140 deg., averaging about 125 deg. The supply tank for the hot treatment has a capacity of 24,000 gallons and for the cold treatment and storage 130,000 gallons.

Mammoth Dam Planned.

Recent news with respect to the hydro-electric development planned by the West Kootenay Power and Light Company on the Pend d'Oreille River, in the province of British Columbia, is that the company has decided definitely on a single dam for the harnessing of the 17-mile stretch of this mountain stream in Canadian territory. The project will involve construction of a dam nearly 400ft. high, the greatest of its kind in Canada. The West Kootenay Power and Light Company is a subsidiary of Consolidated Smelters, and the parent organisation requires large additional amounts of power, especially for its large new fertiliser plant at present under construction at Trail at a cost of nearly 10,000,000 dollars. The huge dam will make possible the installation of turbines to generate about 300,000 H.P., and in addition to this new development, the company is also going forward with plans for an immediate development of 30,000 H.P. on the Kootenay River.

Addition to Noranda Smelter.

Contracts have been signed for the erection at Noranda Mines of a special addition to the smelter which will recover precious metals residue and by-products. The new unit will be placed at the base of the smoke stack, and will treat the smoke to recover such particles of dust or chemicals as will, it is anticipated, provide a valuable recovery, apart from the regular smelting operations. Equipment for this particular operation was installed by the International Nickel Company at its Copper Cliff refinery, and was the first unit of its kind in use in Canada. The Western Precipitation Company, California, has received the order for the equipment necessary to this undertaking, while the Disher Steel Construction Company, of Toronto, will handle the steel and concrete work for the buildings.

Open Pit Mining.

A new era in the coal mining history of the province of Saskatchewan has been entered with the starting of open pit operations in the Estevan field. The company concerned in this newest departure is the Truax Traer Coal Company. The task of stripping off millions of tons of earth overlying 2½ square miles of lignite coal is being undertaken, and a beginning has already been made by the strip shovel in laying bare this coal. Following the stripping machine is a smaller shovel of the same type, which has a specially designed bucket or scoop to be used in scraping up the coal after the earth has been stripped away. Power for the undertaking will be supplied by the Dominion Electric Company, the plant of which in the Souris Valley, just east of the Truax Traer property, was recently completed. The plant is modern in every respect, and is the first in Canada specially designed to use lignite coal. The overlying earth-covering of the coal measures averages 32ft. in thickness on the Truax Traer property, this covering containing large quantities of gravel which will provide another possible source of revenue. The first lignite seam to be encountered at this point is 10ft. to 12ft. thick, and it is estimated by the company's engineers that there are 25,000,000 tons of coal immediately available on its property.

To Manufacture Whiting.

Discoveries of new uses for its raw material have been made by General Calcium Corporation, Ltd., of Toronto, operators of a large calcium carbonate deposit situated near Campbellville, Ontario. As a result of recent chemical research on its raw product, the company has learned that the whole of its deposit of calcium carbonate, covering an area of 47 acres, is chemically suited for the manufacture of commercial whiting, which, hitherto, has not been produced in Canada. The plant and equipment now in operation at the Campbellville deposit will be enlarged to produce this substance. A part of the existing plant will be converted into a dryer and used to dry the peat humus that covers the deposit of calcium to a depth of 16ft. It has recently been learned by analysis that the overburden, which has hitherto been treated as waste, contains nitrogen in larger amounts than any known peat humus in Canada.

Aviation Matters.

The Judicial Committee of the Imperial Privy Council will be asked to settle the question of jurisdiction as between the Dominion and the provinces, in aviation matters. The appeal arises out of the Supreme Court of Canada's opinion, the effect of which is interpreted to be that the Dominion may control such aviation matters as are involved in international affairs and such aerial activities as the Dominion itself engages in, but that the provinces have definite jurisdiction to control and legislate on aviation within their own territories. Strong objection to the finding is taken by private companies, which contend that it would mean that a company intending to operate a Dominion-wide service would be obliged to register its aircraft in each of the nine provinces of Canada. At the same time, each pilot and other registered mechanician would have to be registered nine times. The confusion that a situation of this character would create, would, they point out, practically compel aircraft companies to discontinue operations.

Synthetic Nitric Acid Plant.

The first synthetic nitric acid plant in Canada has recently been established in the province of Quebec by Canadian Industries, Ltd., for the production of nitric acid from Canadian-made synthetic ammonia. The plant is situated at Beloeil, 25 miles east of Montreal, on the banks of the Richelieu River. At Beloeil is also situated the new superphosphate fertiliser plant of Canadian Industries, Ltd., which was just recently opened. The ammonia for the nitric acid plant is manufactured at Sandwich, Ontario, and is shipped in tank cars to Beloeil. The plant was erected at this point because nitric acid is required for the manufacture of explosives—the plant of Canadian Explosives, Ltd., being situated at Beloeil—and the position is suitable for the production of fertilisers and ammonia chemicals. The plant is capable of manufacturing from synthetic ammonia some 20 tons of 100 per cent. acid per 24 hours of operation. The product is a pure acid, suitable for ammonium nitrate manufacture, but requiring concentration for glycerine nitration.

Tube Plan for Montreal.

A scheme to provide Montreal with a rapid transit underground transportation system at a cost of 65,000,000 dollars has assumed the shape of a definite proposal, placed before the people of that city. The immediate building of 8 miles of subways is proposed to take care of the city's growing traffic problem. The proposal is to build the subway system in three component parts, *i.e.*, a north and south line, an east and west line, and a connection between the two. The proposed system of subways may be more clearly described with reference to the waterfront, since the metropolis has been built up fronting on the St. Lawrence and surrounding Mount Royal, dominating heights behind the central part of the city. The so-called North subway, starting from a point in the financial district close to the waterfront and the principal ocean termini would extend back to a terminus nearly at the back of Mount Royal, where connection with surface street car lines would afford transportation for the large population in the north-west part of the city. The east-west subway would run parallel to the St. Lawrence and would pass through the heart of down-town Montreal. The connecting link between the two major subways would also traverse a most thickly congested area.

Provincial Letters.

THE MIDLANDS AND STAFFORDSHIRE.

(From our own Correspondent.)

Industrial Retrospect.

THERE will be no regret in Midland industrial circles at the passing of the year 1930, for it has proved a year of disappointments and of hopes unrealised. Few there are who care to go back over last year's trading, and everywhere there is manifest a keen desire to "black out" the past twelve months and concentrate upon the New Year. The Midlands and Staffordshire, in common with other industrial centres, have suffered severely during the trade slump of 1930, and were it not for the diversity of its products, the position would have been sad indeed. While at some time or other during the year practically every district trade has had a slack period, there has generally been activity in one or more of the other trades, so that in the Midlands there has been some mitigation of the general hardship. The heavy industries, which remain the most important in this part of the country, suffered the most. Since the spring the demand for iron and steel has decreased markedly, owing, in part, to a falling off in activity in the engineering trades allied with the iron and steel industry. Ironfounders, tube makers, boilermakers, producers of bolts and nuts and of edge tools are among those who have suffered much. The big decline in overseas trade has had a most serious effect on local manufacturing industries, while the stern competition with foreign rivals has not been conducive to profitable trading. The Midland automobile industry has not had a good year, but it has been fortunately placed when compared with some other branches of engineering. Firms engaged on the production of electrical plant have been moderately busy. Indeed, thanks to national electrical development schemes, electrical firms in this area have worked consistently throughout the greater part of the year. Manufacturers of steel window casements have also cause for some gratification.

Outlook for 1931.

The coming of the New Year has brought hope to Midland and Staffordshire industrialists, for, although leaders of trade and industry the kingdom over differ as to whether or not an industrial revival may be expected at a comparatively early date, they seem fairly generally agreed that the present depression will begin to pass away during the current year, and that before the year is out an improvement will set in. The views expressed by prominent industrialists this week have certainly not been pessimistic, and though their optimism has been qualified, it has been a source of satisfaction to iron and steel masters, engineers and manufacturers hereabouts. The opinions of the chairman of the Federation of British Industries are necessarily momentous, and he believes that a revival in world trade is likely to set in during 1931 in the sense that the volume of new business will begin to increase. Additional importance is given to this view by the backing given to it by the chairman of Steel Industries of Great Britain, Ltd. He asserts that there is no reason to be pessimistic, as the present world-wide depression, however serious it may seem, is a passing phase. Past experience justified the anticipation that a turn would not be delayed beyond the second half of the New Year. There is, then, at least, a ray of hope that 1931 will improve upon its predecessor, and industrialists here are inclined to be more optimistic and more hopeful of better times.

Labour Problems.

The year 1931 opens with two serious industrial labour problems awaiting settlement. In the railway world the trade unions' proposals for increases in salaries and wages have been met by the companies laying claims to drastic reductions, and early this year the matter will have to be thrashed out. In the coal industry a temporary peace has been made to enable the industry to keep going for a month or so, but the outlook can only be described as uncertain. Nevertheless, although there exist ominous clouds over the labour world, there are evident signs of a desire on the part of all the parties concerned to reach, if possible, a peaceful settlement of the problems at issue. As regards the local coalfields, Cannock Chase is working on a spread-over of 8 hours for five days of the week. South Derbyshire has reverted to the 8-hour day, while North Staffordshire miners are still negotiating with the owners with a view to the conclusion of a spread-over agreement. In the Warwickshire coalfield, the National Board has decided that neither a spread-over nor a wage reduction is necessary. It is the most fortunately placed coalfield in the district and has been doing comparatively well for some time past.

Midland Industries.

Many factories and workshops in the Midlands and Staffordshire had extended holidays, and work has not yet been resumed at all of them. Monday next, however, should see all hands for which work is available, busily engaged. Though the depressed state of trade is general and extensive, it is believed that with energy and resource on the part of everyone concerned, conditions will mend. Manufacturers alike of materials and finished goods are hoping for freedom from labour troubles, for less Government interference with industry and a reduction in taxation, all of which would materially add to the chances of a trade revival. In the case of the former, there is an increased outcry for the protection of iron and steel from the ravages of continental competition. Heavy, structural and general engineers begin the year with little business in hand, and forecasts are not bright. In the lighter engineering trades, it is thought that prices may fall still further, in the hope of establishing a position when a rise in demand may be looked for. Just now they are disinclined to purchase material. Automobile engineers find an improvement in the volume of business coming through, and several of the leading industrialists in this branch of trade express the opinion that the motor industry has reasons to expect improved conditions this year. They are not prepared to say that trade will be substantially better, but there is certainly no occasion for pessimism. Makers of engines, gear-boxes and the pressed steel chassis for the trade are fairly well situated for work. Motor car manufacturers in Coventry in particular are making strenuous efforts to expand overseas trade. Light car makers are competing with one another for the home market, while makers of heavy transport vehicles believe there will be an even larger demand this year than ever before for their productions. Midland rolling stock firms have a tolerably good carry-over of orders, but new business is not coming along as well as they would like to see it. The hardware and hollowware trades of East Worcestershire are fairly well placed, but foreign business continues poor. There is no improvement in the Black Country industries reported above as being under a cloud. Firms making chemical plant are steadily engaged as are makers of stoves. The outlook in the chain and anchor trade is rather discouraging. Taken on the whole, Midland industries start the year in a less healthy condition and with, at best, no better prospects than they commenced the year 1930.

Steel Prospects.

Though depressed conditions remain in the steel trade, and although the industry is handicapped in relation to other steel producing countries, there are steel masters who believe that better business will be done this year than was done last. It is suggested that the industry is a growing one, and statistics have been quoted to prove that British steel masters are holding their own in the world market. During the past year, in endeavours to keep as much as possible of the home trade for native mills, producers of finished material have made special substantial rebates to buyers who undertook to purchase none other than British steel. Makers of semi-finished material have made considerable sacrifices in price in a like cause, as may, in some measure, be judged from the fact that whereas at the opening of last year small bars were selling at £8 2s. 6d., they are now to be bought at £7 7s. 6d., a reduction of 15s. per ton. Mild steel billets, which were £6 5s., are now offered at £5 12s. 6d., a fall of 12s. 6d. To-day, business is as keen as ever, and the disparity between native and foreign prices is so substantial that a considerable amount of continental steel material is being bought despite all the efforts of local steel masters to counteract this invasion. At date, there seems small prospect of any material change in this department of the steel trade, but during the next twelve months almost anything might happen, and Government action might result in Staffordshire steel masters' prices approximating much more closely to those of their foreign rivals than they do to-day.

Raw Iron.

The past year, if it has not provided Midland pig iron producers with as much business as they could have wished for, has, from one point, at least, proved very satisfactory. The manner in which smelters have proved loyal to their Association and the strictness with which they have adhered to the Association's fixed prices, has astounded many merchants and consumers in this district. It had been freely stated that it only needed conditions such as have existed in the industry for the past six months to witness a break-away from the Association. Smelters have proved remarkably strong, and at the end of the year, in answer to threats to use continental raw iron, they formulated and announced a rebate scheme to buyers exclusively of native pig, thus following the example of the associated steel masters. The scheme has aroused much interest and should act as a protection to the furnacemen against any recurrence of the small foreign invasion of a few months back. It is interesting to note that Midland pig irons are, to-day, 7s. 6d. per ton cheaper than at the opening of the year 1930.

Finished Iron.

The Staffordshire bar iron mills start the year with poor anticipations. The probability is that business will continue much as during the past year, namely, moderate to good in the marked bar and tube strip departments, and poor to bad in the Crown bar and the nut and bolt bar branches. Conditions have changed little since January of last year, and prices, with the exception of gas tube strip, which are lower by half-a-crown to 5s. per ton, are on the same level as then obtained. Exacting engineering requirements provide the chief cause for demand for best grade iron. Competition from outside districts is prevalent in the Crown bar trade, while Belgian competition in the common bar branch is unanswerable. Galvanised sheets are in poor request, the export markets being unresponsive to price reductions. Corrugated sheets of 24-gauge offered at £11 5s. per ton are 22s. 6d. per ton cheaper than they were at this time last year. It is noteworthy that business during the closing quarter of 1929 was extremely poor, as it has been again this year.

LANCASHIRE.

(From our own Correspondents.)

MANCHESTER.

What of 1931?

VIEWS as to prospects in the engineering trade in 1931 are rather mixed, and, on the whole, perhaps not too optimistic, although Mr. L. F. Massey, who is vice-chairman of the Engineering and Metals Section of the Manchester Chamber of Commerce, in a reasoned statement this week, is inclined to be moderately hopeful. In reviewing the experience of the past year, he points out that the first few months showed some improvement in the rate at which orders were received, although there was a marked falling off in the later months, with the result that the year ended with unemployment in the engineering trade more than doubled, the average monthly value of machinery exports about 10 per cent. below the level of 1929, and a number of important works closed down. Whilst recognising that these conditions provide little sound foundation upon which to base high hopes of greater activity in 1931, Mr. Massey holds that favourable factors are that firms have been busy in evolving new ideas and keeping their products up to date, and in reorganising their productive machinery with a view to manufacturing at cheaper rates. In consequence, some of them are not without hope of being able to secure a bigger volume of orders this year. On the other hand, as a limiting factor to any marked industrial recovery, Mr. Massey emphasises the heavy burden of taxation in this country as compared with competing countries.

Calling a Halt.

In respect of Mr. Massey's last point, a practical step in the direction of reducing municipal taxation has been taken by the Bolton and District Engineering Employers' Association. In initiating a campaign against the high wages paid to municipal employees compared with those employed in unsheltered industries, the Executive Committee of the Association has passed a resolution in the following terms: "That in view of the necessity for rigid national and local economy, the Town Council be requested to reduce the wages of their employees to a rate in accordance with those paid by productive industry." Copies of this resolution have been forwarded to the Town Councils within the area covered by the Bolton and District Association.

A Large Waterless Gasholder.

Constructed by R. and J. Dempster and Co., Ltd., Manchester, at a cost of £20,000, for the Hyde Gas Company, what is claimed to be the second largest waterless gasholder in the North of England was officially opened on Monday of this week. The new holder, which is 100ft. in diameter and 153ft. in height, has a capacity of a million cubic feet.

No Interim Dividend.

Whilst declaring a dividend of 5 per cent. per annum on the preference shares for the six months ending November 30th, the directors of Edward Wood and Co., Ltd., constructional engineers, Ocean Ironworks, Trafford Park, Manchester, announce that no interim dividend on the ordinary shares will be paid. In the two previous years, interim dividends of 2½ per cent. were paid, making, with the final distribution of 4½ per cent., a total of 7 per cent. for the year, compared with 6 per cent. for 1927–28, 4 per cent. for 1926–27, and 2½ per cent. for 1925–26, no dividend at all on the ordinary share capital having been paid for the two years 1923–25.

Non-ferrous Metals.

In spite of the very brief trading period, the market for non-ferrous metals during the past week has provided a good deal more interest than for a long time. This has been due primarily to the fact that an effective scheme of output restriction in the case of tin has been prepared by the Producers' Association, and is under consideration by the Governments of the four principal producing countries, which between them account for 90 per cent. of the total world output. The scheme is intended to be retrospective from the beginning of 1931 and to have a life of two years. Market sentiment has undergone a distinct change, and is now definitely "bullish," with values appreciably higher than they have been during the past month or so. For the time being, opinion favours a period of more stable prices. Copper has experienced a certain amount of fluctuation, but, on balance, quotations have finished up higher in sympathy with tin, and more speculative interest in the metal has been aroused. Lead and spelter also have displayed a steadier tone, but in the case of the latter particularly, there is not a great deal of faith at the moment that the improvement can be maintained.

Iron and Steel.

The iron and steel markets during the past week have been extremely quiet, and very little buying interest in any section can be reported. Sellers, however, are anticipating that a return to the conditions prevailing before the stoppage will be experienced next week. Deliveries of foundry iron have been adversely affected by the closing down of a number of consuming works, but there has been no quotable change in the price situation, Derbyshire and Staffordshire No. 3 being at 69s. 6d. per ton, forge iron at 64s. 6d., Northamptonshire foundry at 68s., Scottish at about 91s., and West Coast hematite iron at 84s. 6d., all for delivery equal to Manchester. Very little business is being done at the moment in bar iron, but offers of Lancashire products keep up at £10 5s. per ton for Crown quality bars, and about £8 15s. for No. 2 material. The demand for steel is quiet, and is likely to continue so until after the Association meeting, for consumers in this area are again strongly of the belief that price concessions will follow. Boiler plates, both acid and basic sorts, are on the easy side at £9 5s. to £9 7s. 6d. per ton, and re-rollers are now quoting small bars at down to £7 2s. 6d. Otherwise market values have been maintained. Foreign steel prices are nominally unchanged, but trade is quiet so far as this market is concerned, and it is believed that the attitude of continental sellers is less firm than it has been of late.

BARROW-IN-FURNESS.

Hematite.

There is a tendency on the part of makers in the direction of greater expectations about trade generally in the New Year. At present the foundations are not very substantial for this belief, but certainly there is a slightly better tone. Millom put out a furnace, and that gave the impression in some quarters that it meant reduction of output; but another furnace which has been overhauled has been put in. Stocks rule high everywhere, but it is hoped that they will come down. There is no production of pig iron at Barrow at present. Foreign business is still on the quiet side, and the shipments overseas are not heavy by any means. What is needed is renewed

activity in the steel departments, for it would mean a considerable absorption of iron and stop much, if any, going into stock. Iron ore, both native and foreign, is in very quiet demand at present. The steel market is dull, and neither the Barrow nor Workington rail mills are working.

Shipbuilding.

Shipbuilding is moderately active at Barrow, and work on the construction of the two P. and O. ships is proceeding apace, but the fact that no fresh orders for merchant ships have been secured means that an idle period for many will occur in course of time. True, there are the Admiralty orders, but they do not call for such considerable labour and material as do merchant vessels. On the engineering side, there is a rather better outlook, for apart from gun mountings, &c., there is the machinery for various naval contracts, including the cruiser which is to be constructed at one of the dockyards.

SHEFFIELD.

(From our own Correspondent.)

Poor Position of Heavy Steel.

THE heavy steel-producing department of local trade affords little or no material this week for a review of actual working operations, as production is practically at a standstill, owing to the holidays and to stocktaking. One must therefore deal principally with prospects, and they are the reverse of good. Demand has been on a very small scale for several months, and there are no signs of an early improvement. A fortnight's stoppage is to be general at the Ickles and Templeborough Works of the United Steel Companies, where stocktaking is in progress. The resumption of operations on the heavy side of the big Sheffield works will depend on the extent to which orders accumulate during the stoppage. It is probable that certain important departments will remain closed three weeks. In Lincolnshire, too, the steel works are down for two and possibly three weeks. A blast-furnace at the Appleby Works, Scunthorpe, was damped down shortly before the end of the year, which reduced the employment of the works to about half capacity. Work continues scarce in the railway axle, tire, and spring departments, but there is a good deal of activity in patent buffers. The call for shipbuilding steel and tools for the shipyards is also on a reduced scale, but it is expected to improve shortly as a result of the newly placed Admiralty orders.

Stainless and Heat-resisting Steels.

In the finished departments the stoppage of work is shorter, and the conditions of employment better. Some branches were set down for a few days only. A fairly satisfactory branch is that which produces supplies for the automobile industry. Although it has not been nearly so well employed in 1930 as in recent years, a large volume of work has been turned out. The demand in respect of commercial cars has kept up pretty well, but there has been a falling off in touring vehicles. Another good branch is that of stainless, non-corrodible, and heat-resisting steels. There are now many kinds of these materials, adapted not only to the original purpose of cutlery making, but to a number of important engineering uses, and the demand is constantly spreading. Sheffield no longer has the monopoly of production, but it continues to turn out a very substantial quantity of the steels, and occupies the leading position in the trade. During the past year one of the Sheffield firms has introduced a notable new alloy of this character. The firm is John Brown and Co., Ltd., which has brought out at its Scunthorpe works a heat-resisting steel which is claimed to be virtually impervious, at temperatures up to 1000 deg. Cent., to the action of furnace or similar gases, including those in which sulphur and sulphur dioxide are a constituent part.

Sheffield and Darlington.

The production of stainless and rustless alloys is to be extended to Darlington, where the Darlington Rustless Steel and Iron Company is erecting works which are expected to be completed about three months hence. This development is of special interest to Sheffield, as Mr. J. L. Bentley, the managing director of the new company, belongs to this city and received his metallurgical education at Sheffield University. Subsequently he was employed for about fifteen years by various firms in Sheffield. He has recently returned from America, where he has been studying the processes in operation. It is understood that rustless materials will be produced at Darlington by a process which differs from those employed at Sheffield. For example, chrome ore will be introduced into the melting furnace instead of ferro-chrome, as is used by the Sheffield makers. Mr. Bentley thinks that America is ahead of this country in the number of applications of stainless materials to industrial purposes.

New Type of Railway Wheel.

The centrifugally cast Davis steel wheel for railway rolling stock, which is a production of John Brown and Co., Ltd., at Scunthorpe, has been further developed during the year. A special type has been introduced in which the tread composition and heat treatment are arranged to produce a wheel which is specially suited to resist the severe wear resulting from prolonged brake application and other causes. This type will be particularly applicable overseas, where gradients are encountered which are of an entirely different order from those common in England. It will also meet those many cases in which brake van wheels, locomotive tender wheels, and electric stock are subject to abnormal braking. The introduction of the new wheel has been attended with success, and repeat orders have been received.

Cold-rolled Strip.

As I have pointed out on several occasions, there has been a serious falling off recently in the demand for cold-rolled steel and strip—one of the newer industries of this district, which had previously enjoyed much activity. J. J. Habershon and Sons, Ltd., of Rotherham, who are very large producers of strip, state in their works magazine that 1930 was a bad year. The poor trade recorded in June became worse throughout the summer months. Not until October did a slight improvement in orders and output become apparent. It has since been maintained, but the works are far less busy than usual at this time of the year. They add that they cannot see any positive signs of improvement in the near future, as British industry is intimately involved in a general world depression.

Twist Drill Success.

The Sheffield Twist Drill and Steel Company, Ltd., reports good progress. At a staff dinner last week, one of the managing directors said that since the foundation of the company in 1915 the output had increased six or seven times. Severe competition, both at home and abroad, had been met in part by turning out more drills at a reduced margin of profit.

Coke Oven Gas.

There is keen rivalry for the acquisition of powers to increase the supply of coke oven gas to various undertakings in South Yorkshire. Both the Sheffield Gas Company and the coke oven owners themselves are anxious to make use of the great quantities of gas that are at present unconsumed. The Gas Company, which already takes large quantities of gas from the coke ovens and uses it to supplement its other supplies, is promoting a parliamentary Bill to enable it to bring in gas from ovens situated further away from Sheffield than its present powers allow. At a meeting of the company last week, at which the Bill was approved, the chairman said that the powers which the company sought had been challenged by the coke oven owners in South Yorkshire, who had formed a company called the South Yorkshire Grid Company, and that company was also promoting a Bill in which it sought powers to convey gas from its coke ovens to gas and industrial undertakings in South Yorkshire. He added that the directors of the gas company were naturally not prepared to agree to the business of gas distribution being taken out of the hands of the gas industry, and were of the opinion that the interests of the community would be better served by an extension of the system the company had already adopted.

An Important Electricity Station.

The importance of the Rotherham Corporation power station under the electricity "Grid" scheme was emphasised in a recent lecture by Mr. E. Cross, the general manager of the electricity department. He stated that on a site adjoining the station there would be erected transforming gear capable of stepping up 80,000 H.P. of electricity from the station's generating bars at 6600 volts to 132,000 volts, and that the lines from these transformers would be carried overhead to a switching station at Northfield. From Northfield the lines would be continued overhead to the Blackburn Meadows station of Sheffield Corporation, and in another direction from the same point they would be continued to Lincoln. There were also arrangements for the transmission of power to Doncaster through a secondary line carrying 33,000 volts. Mr. Cross stated that Rotherham's generating costs last year were 0·23d., and the average selling price was only 0·64d.

NORTH OF ENGLAND.

(From our own Correspondent.)

A Retrospect.

INDUSTRIALISTS in the North of England heaved no sighs at the passing of 1930. It has been a year of difficulty, and a continual fight against trade adversity. With its many idle pits and factories, derelict shipyards, smokeless blast-furnaces and partly employed steel rolling mills, the industrial North presented a depressing picture throughout the year, and the plain fact emerged, above all others, that industry generally could not produce as cheaply as foreign competitors. This is the great problem to be tackled, and it would appear that it can only be accomplished by the concentration of production in large and efficient units. Already, this process has taken a definite form so far as the iron and steel industry in the North of England is concerned, and although it is too early yet to determine the real result, there is no doubt that some success has been achieved. The unification of the control of the largest iron and steel-producing plants on the North-East Coast has led to the scrapping of much obsolete producing plant, and the modernisation of manufacture and the concentration of production in large and efficient units. The effect is likely to be seen in the future by the lowering of production costs, though there are still great obstacles in high taxation and rates.

The Outlook.

The future is not without encouragement, especially in the iron and steel industry. Under close observation one is able to discern a gradual improvement in the demand, and there is every prospect of the movement continuing. Greater success may be attained when conditions are more favourable to a restoration of world trade, but in the meantime it is gratifying to find that constructional steel and engineering firms in this area are able more than to hold their own against their foreign rivals in the fight for the largest contracts. In recent months remarkable success has been achieved in the direction indicated, and most of the steel constructional firms enter upon the New Year with work in hand that will keep their plants in a state of activity for many months ahead.

Cleveland Iron Trade.

Business on the Cleveland iron market is more or less suspended. The consuming works are closed for a longer period than is usual at this season, some of them being shut down until Monday next. Under such conditions, pig iron stocks are increasing considerably, but the limited output is not likely to be found excessive by the second week of the New Year. The temporary curtailment of make by a furnace going out for repairs at the Normanby Ironworks increases the number of blast-furnaces idle on the North-East Coast to 68, out of the 92 built. Of the 24 blast-furnaces now blowing, seven are producing Cleveland pig iron, seven hematite, and 10 other kinds of iron. Consumption of continental pig iron by Tees-side firms is rather considerable, and further buying of foreign iron is threatened unless prices of Cleveland are reduced. Midland iron is also being more extensively used in this district. No. 1 Cleveland foundry iron is 66s., No. 3 G.M.B. 63s. 6d., No. 4 foundry 62s. 6d., and No. 4 forge 62s.

Hematite Pig Iron.

There is now very little business passing in the East Coast hematite pig iron trade. Mixed numbers are at 70s., and No. 1 quality at 70s. 6d., but terms of contract are a matter of individual negotiation and vary somewhat. Sellers look for an early renewal of home buying.

Ironmaking Materials.

Foreign ore is virtually unsaleable, consumers being heavily bought and having large supplies on hand. Best Rubio ore is no more than 16s. c.i.f. Tees. Blast-furnace coke keeps in ample supply and in only moderate request. Good average qualities are quoted at 17s., delivered at the works.

Manufactured Iron and Steel.

Recent fairly substantial business in constructional steel is very welcome, and encourages hope of an early improvement of demand for other commodities. Orders for nearly all descriptions of manufactured iron and steel, as well as for semi-finished materials, are urgently needed. Prices are unchanged.

The Coal Trade.

Difficulties in the Northern coal trade are increasing, and the forward outlook causes both owners and merchants to take a somewhat gloomy view of the trade for the next few months. There have been transactions in coking coal over the first three months of the year at about current prices, but other kinds of fuel are without forward movement. This latter condition is due to the operation of the Coal Mines Act. The effects of this legislation are diverse and far-reaching. Pits which normally work regularly have been restricted in output as from January 1st, under the quota system, and many miners are to be dispensed with; while, on the other hand, collieries which have not trade up to the quota level are likely to benefit through a better price for coal, due to lessened production. Thus, the owners and the men at the pits producing the most saleable coal are to suffer under the Act. The position in the gas coal trade is disturbing. Several French gas companies have recently been negotiating for their gas coal requirements during January. Orders generally ranged from 5000 to 6000 tons each, as a rule Wear intermediate qualities being preferred. These orders, however, have, on this occasion, been placed for American qualities to be delivered at c.i.f. prices, fully 1s. per ton below the prices quoted on this side. It is stated that American coal of equivalent quality is being offered at the overseas shipping ports at 2s. to 2s. 6d. below current Durham prices, and as the freight rates are only about 1s. higher than from the Tyne or Wear, the Americans can easily undercut Durham by 1s. per ton or more. The reduction in output under the quota allowances is likely to be less than requirements. Hence, prices may rise for shipment, but sales abroad will only be possible at prices equivalent to other area values. January prices, however, are quoted firmly. Best gas coal commands 15s., and second qualities 13s. 6d. to 13s. 9d. For bunker classes the prompt position is firm, and any offers for best at 14s. and good ordinary at 13s. 6d. are snapped up. For the first half of January all steam coal fitters report well filled order books, while they are well supplied with tonnage Prices are, therefore, quoted steadily. The more forward position is irregular, but both producers and exporters are marking time. Best Northumberland steams for prompt sale are firm at 13s. 9d., and for all this month at fully 13s. 6d. The coke section has still its weak places. There appears to be more patent foundry coke than the market can absorb, and there is talk of reducing the output. Were it not for a fair home demand, supplies would be uncomfortably excessive. For shipment the ordinary qualities are offered at 17s. to 17s. 6d. Higher classes are about 20s. There is no improvement in the iron and steel industry to give a fillip to the blast-furnace coke position. Sellers ask 17s., but there is no strength in the quotation. For gas coke 21s. 6d. is a strong figure. Beehive makes are experiencing a steady sale at 24s. to 28s.

SCOTLAND.

(From our own Correspondent.)

The "Festive" Season.

MARKETS have been more or less of a holiday character since just before Christmas, and conditions are likely to remain unchanged for a week or so longer, owing to the industrial depression and the probability of extended New Year holidays.

Clyde Shipbuilding.

The output from Clyde yards during 1930 amounted to 246 vessels, aggregating 529,744 tons, compared with 222 vessels of 565,798 tons in 1929. While the output has been comparatively good, the position with regard to fresh orders has all along been unsatisfactory, which can be noted by the rapid drop in the tonnage in hand in the various yards. In January the work in hand

totalled 547,324 tons, in April 573,241 tons, but by July the total had fallen to 466,304 tons and to 406,652 in October. The shrinkage, therefore, within six months was over 150,000 tons, and if the figures for January, 1931, approximately 450,000 tons, had not been "boosted" by the giant Cunarder, the position to-day would not show any improvement compared with October. Compared with last year the output of machinery also shows a substantial drop, with the total output at 601,334 I.H.P., compared with 778,057. The number of yards has been reduced by three by the rationalisation schemes of the National Shipbuilding Security, Ltd., but there is ample accommodation in the remaining yards to meet any orders forthcoming. Apart from the commencement of work on the new Cunarder, the only recent item of interest was the Government contract for two destroyers placed with the Fairfield Shipbuilding and Engineering Company, Ltd., Govan.

Steel and Iron.

Business in steel is quiet and, as has already been indicated, the holidays will in almost all cases be longer than usual. At some works closing notices are posted, but no mention is made of the time of restarting work. Inquiries are said to have shown an increasing tendency, but actual business is necessary to ensure a good beginning for the year. Orders for heavy steel have been spasmodic for a long time back, and an improvement is long overdue. Steel sheets are slow, but the slight increase in the turnover for galvanised descriptions shows signs of continuing. The tube trade is most unsatisfactory, and some of the works are already closed down for the New Year holidays. There is no change in bar iron or re-rolled steel bars, the turnover being at a minimum. The latter are still quoted £7 7s. 6d. home and £7 5s. per ton export. The output of pig iron is still limited to six furnaces and is quite sufficient to meet all requirements. Heavy steel scrap is quoted 50s. and cast iron machinery scrap 60s. per ton.

Coal.

The turnover in coal has been on a reduced scale of late. Industrial depression and milder weather affect the home market and high prices make export transactions almost impossible. Exporters are merely taking quantities necessary to complete shipments where tonnage has been chartered and are not in a position to consider business from abroad in competition with Poland or Germany. Consequently little or nothing has been sold for January loading and prices are nominally unchanged.

WALES AND ADJOINING COUNTIES.

(From our own Correspondent.)

Coalfield Stoppage or Not?

AT the time of writing, the question on everyone's lips was whether there was to be a stoppage of work in the coalfield at the end of December, and whether the miners' leaders and the coalowners had said their last word. The outlook on Tuesday was certainly about as black as it could possibly be, inasmuch as after a two hours' conference of the members of the Joint Coal Board Subcommittee no satisfactory result had emerged, and a meeting of delegates from the coalfield was held to consider the situation. From the men's side the statement was made that the Joint Sub-committee had failed to agree, while from the coalowners' secretary the admission was forthcoming that no settlement had been arrived at; yet he dissented from the view that there had been failure to agree, remarking that he would explain the position later. This explanation is probably that the coalowners have simply not got the means to meet the terms of the men's leaders and that they cannot pay the same remuneration for a seven and a half hour day that they paid for eight hours per day. As to the developments that have taken place since the last issue of THE ENGINEER, all that need be mentioned is that the South Wales Miners' Federation reported to the National Industrial Board the fact that in this district there had been a failure to come to terms. The case for the Federaton was discussed by the Board in London on Monday, but the coalowners were not present or represented, this being in accordance with the determination which they have expressed from the outset. The coalowners had offered to extend the temporary agreement, arranged at the end of November, until the end of January, and if in the meantime a permanent agreement to apply to the coalfield had not been come to by January 14th, then the points in dispute were to be placed before an independent arbitrator. The men's leaders rejected the coalowners' offer, as under the method of working the "spread-over" of hours the men were at a financial disadvantage, as the day-wage men lost one day's work and pay a fortnight, and piece-rate men were not compensated. As to the outcome of the men's case before the National Industrial Board, the recommendations from that body were a continuation of the existing coalfield agreement up to the end of March next, and thereafter until altered by agreement between the parties, subject to a revision of hours of work. Concerning the last-named point, the Board put forward two suggestions. One was that hours of work below ground should be 7 hours and 36 minutes for five days a week and 7 hours on Saturday, or, alternatively, 7 hours and 40 minutes for five days a week and 6 hours and 40 minutes on Saturday; the hours of surface men to be adjusted by local agreement. The answer of the coalowners to these recommendations is that they have not got the money to enable them to agree to such terms. Despite the blackness of the outlook hopes have not been abandoned of work being continued in the coalfield. If the worst comes to the worst, the coalowners will no doubt post notices at the collieries setting forth the terms on which work can be continued by the workmen, and the view is held that many miners will desire to remain at their jobs. The Craftsmen's Association has agreed that in the interest of all concerned the Association should allow all the necessary safety men to continue in employment, and so far as any question is in dispute between them and the coalowners, it shall be decided by an independent arbitrator.

LATER.

Following on the abortive conference on Tuesday, the South Wales coalowners posted up at the collieries the terms on which work was available as from January 1st. There were two notices, viz., "A" and "B." The "A" notice stated that the hours of work for men underground would be 7½ for every shift on every day of the week, and those for surface men would be 48 hours per week of six days, exclusive of meal times. The rates of pay would be the same as those now prevailing, and the bonus turn, payment for week-end overtime, and other terms and conditions would continue, except that in the case of day-wage workmen who work 7½ hours per shift, the rate of payment would be fifteen-sixteenths of the present rates. Rates of pay for pieceworkers would remain unaltered, and work would be on day-to-day contracts. The "B" notice stated that the owners were prepared to continue for the month of January work upon the terms and conditions prevailing during December, which, of course, involves the "spread-over," which the South Wales Miners' Federation has rejected. On Wednesday the situation was certainly very critical, but not regarded as hopeless. Officials from the Mines Department and Mr. Vernon Hartshorn, the Lord Privy Seal, were in Cardiff, but not in the capacity of intervening officially—simply for investigation purposes. The Executive Council of the South Wales Miners' Federation met hurriedly to consider the position, and sent messages to the districts instructing local staffs to refrain from advising the men to stop work until they heard later from the central office. On the other hand, the Executive of the South Wales Miners' Industrial Union meeting in Cardiff recommended their members to accept the coalowners' "A" offer for a temporary settlement. The prospect therefore was that, failing an official settlement, some men would be at work and others would stop. However, despite last minute efforts on Wednesday night, no agreement was come to between the coalowners and the miners' leaders, and as a result the members of the South Wales Miners' Federation were instructed not to work on Thursday. The stoppage is likely to continue until the end of the week. There will be a meeting of the Coal Conciliation Board to discuss the terms and conditions of a new agreement.

Effect on Trade.

The existing uncertainty in the labour sphere has pretty well brought business to a standstill, and the point uppermost in the minds of all on the commercial side is the effect which may be produced on the placing of one or two important contracts pending. The Central Argentine Railways have bought on an f.o.b. basis between 400,000 and 500,000 tons of steam coals from this district for delivery over 1931, and the British Admiralty has purchased its requirements, estimated at round about 100,000 tons, which compares with about 1,750,000 tons in pre-war days. Tenders were opened on Tuesday at Cairo for the supply of 155,000 metric tons of locomotive coals for the Egyptian State Railways for delivery at Alexandria over the first few months of 1931. The lowest tender for Welsh coals is that from Gueret, Llewellyn and Merrett, Ltd., at 24s. 8½d. per ton c.i.f. Alexandria, and there is also an offer of Westphalian coal from the Deutsches Kohlen Depot at 24s. 8d. c.i.f., but the latter is understood to be for only a part of the railways' requirements. Tenders have to hold good for fifteen days, and the likelihood is that the railways will not definitely place the contract until they see what are the chances of coals being delivered from this district. They may defer a decision and ask later for fresh tenders, though they have already once postponed the matter. On the other hand, they may purchase supplies elsewhere, which, of course, would be bad for the Monmouthshire collieries, from which the bulk of the coals are usually drawn. Then, again, there is the pending contract from the Portuguese State Railways, which have called for prices for 100,000 tons of small coals for delivery over the first few months of the New Year. The question is being asked, What will they do in the circumstances? Business generally is in a state of suspense, and the uncertainty prevailing is playing havoc with operations.

Quotas and Minimum Prices.

Colliery companies in this area have received from the South Wales Coal Marketing Association their quotas for the first quarter of the New Year. Compared with the production of the first three months of 1930, they range from 10 to 20 per cent. less, the average reduction being about 12 per cent. A revised schedule of minimum prices has also been issued to operate as from January 1st, but actual revision in prices of coals for export affects mainly, if not entirely, those coals which up to the passing of the Coal Mines Act were outside the voluntary scheme. In the case of coals for inland purposes, minimum prices are generally placed 6d. per ton below the f.o.b. minima for each class, but in the case of gas coals for inland sale, prices all round have been revised and involve in some cases an advance of 1s. per ton. Another alteration in the scheme is that the prices for steam coals are fixed for the "normal" port of shipment, and if they are transferred to another port for loading, then extra leadage is incurred. In the past, collieries have been able to waive the charge for extra leadage if they desired to do so.

Works Restarting.

It is some satisfaction to see certain works restarting. The Mannesmann Tube Works, Landore, Swansea, made a resumption of work on Monday, and the majority of the 1200 workmen concerned were reinstated, while it was expected that the remainder of the workmen would be taken on by the end of this week. Questions at issue between the company and the workmen are to be the subject of arbitration at a later date. The Duffryn Steel Works, Morriston, restarted on Monday, and work for 300 men was found. Tin-plate works at Llanelly resumed after the Christmas holidays, also the Llanelly Steel Works, which had been idle several weeks owing to trade depression. The Llanelly Sheet Works, which had been at a standstill since March last, reopened on Monday. There is also to be a restart of operations at the wire rope works at Cardiff formerly carried on by George Elliot and Co., Ltd., as soon as possible. These works closed down in October, but they have been acquired by Bruntons, of Musselburgh, and Mr. Kenneth Davies, of London, the latter being a son of the late Sir John Cecil Davies, who was formerly vice-chairman of Baldwins, Ltd. The works are to be re-equipped.

Electrical Amalgamation.

A provisional agreement, which has to be confirmed by shareholders, has been entered into, whereby the Shropshire, Worcestershire and Staffordshire Electric Power Company will purchase the whole of the debentures, preference shares and ordinary stock of the South Wales Electrical Power Distribution Company, now held by the South Wales Power Company, Ltd. The effect is that the Shropshire undertaking will become the owners of the South Wales Electrical Power Distribution Company, which, since its reorganisation in 1923, has made great progress. The present directors of the South Wales undertaking will retire, and a new board will be nominated by the Shropshire undertaking, though Mr. W. North Lewis has been invited to continue as chairman.

Current Business.

The tone of the market for steam coals is extremely quiet. The tonnage at the disposal of collieries is not up to expectations. It was thought that as the result of the holidays there would have been an accumulation of steamers which would have enabled collieries to ship actively for a time at least, but the dock returns on Monday showed that there were thirty-nine idle tipping appliances, and only one steamer was waiting. Chartering of tonnage since the vacation has been negligible, and unfortunately few fresh orders for cargoes of coal have come along. Prices are nominal, and pitwood is about 26s. 6d. to 27s.

PERSONAL AND BUSINESS ANNOUNCEMENTS.

MR. L. P. SIDNEY, of 76, York Mansions, Battersea Park, S.W. 11, asks us to announce that his telephone number has been changed to Macaulay 3543.

THE GENERAL ELECTRIC COMPANY (INDIA), Ltd., asks us to announce that it has removed its Madras branch from 100, Armenian-street, Madras, to Magnet House, Mount-road, Madras.

CALENDARS, DIARIES, &c.

AITON AND CO., Ltd., Derby.—Wall calendar with monthly tear-off slips.

ASSOCIATION OF ENGINEERING AND SHIPBUILDING DRAUGHTSMEN, 96, St. George's-square, London, S.W. 1.—Diary for 1931.

ATLANTIC TRANSPORT LINE.—Wall calendar with monthly tear-off slips.

THOMAS BOLTON AND SONS, Ltd., Widnes, Lancs.—Pocket diary.

BRISTOL AEROPLANE COMPANY, Ltd., Filton, Bristol.—Wall calendar with monthly tear-off slips.

BRITISH BROWN-BOVERI, Ltd., London.—Wall calendar with monthly tear-off sheets.

BRITISH INSULATED CABLES, Ltd., Prescot, Lancs.—Wall calendar with monthly tear-off slips.

CROFTS (ENGINEERS), Ltd., Bradford.—Wall calendar with monthly tear-off sheets.

DEMAG AKTIENGESELLSCHAFT, Duisburg.—Refill for desk stand.

ENGLISH STEEL CORPORATION, Ltd., Vickers Works, Sheffield.—Diary and case.

FEED WATER SPECIALISTS COMPANY, St. Paul's-square, Liverpool.—Pocket diary.

R. AND W. HAWTHORN, LESLIE AND CO., Ltd., Newcastle-on-Tyne.—Wall calendar with daily tear-off sheets.

HILDICK AND HILDICK, Walsall.—Wall calendar with daily tear-off slips.

HOLMAN BROS., Ltd., Camborne, Cornwall.—Wall calendar with monthly tear-off slips.

IRONITE COMPANY, Ltd., 11, Old Queen-street, Westminster, S.W. 1.—Wall calendar with monthly tear-off sheets.

JONES YARRELL AND CO., 143, Fetter-lane, E.C. 4.—Wall calendar with monthly tear-off sheets.

KELLY AND SONS, 26, Portugal-street, London, W.C. 2.—Desk engagement pad.

LE GRAND, SUTCLIFFE AND GELL, Ltd., Southall, London, W.—Wall calendar with daily tear-off sheets.

LIGHTALLOYS, Ltd., Alpax Works, St. Leonard's-road, Willesden Junction, London, N.W. 10.—Wall calendar with monthly cards.

LIVERPOOL ELECTRIC CABLE COMPANY, Ltd., Linacre-lane, Bootle, Liverpool.—Wall calendar with monthly tear-off slips.

NATIONAL GAS ENGINE COMPANY, Ltd., Ashton-under-Lyne.—Desk calendar. Monthly tear-off sheets and model of gas engine.

RUSTON-BUCYRUS, Ltd., Lincoln.—Wall calendar with monthly sheets.

"SENTINEL" WAGGON WORKS, Ltd., Iddesleigh House, Caxton-street, Westminster, S.W. 1.—Wall calendar with monthly cards.

HENRY SIMON, Ltd., Cheadle Heath, Stockport.—Desk calendar with daily sheets.

SIMPLEX CONDUITS, Ltd., Garrison-lane, Birmingham.—Pocket diary.

STAVELEY COAL AND IRON COMPANY, Ltd., near Chesterfield.—Pocket diary.

S. S. STOTT AND CO., Lancside Foundry, Haslingden.—Wall calendar with monthly tear-off sheets.

SWISS LOCOMOTIVE AND MACHINE WORKS, Winterthur.—Wall calendar with monthly tear-off sheets.

TEMPLE PRESS, Ltd., 5/15, Rosebery-avenue, E.C. 1.—Copy of *Motor Cycling* diary.

JOHN I. THORNYCROFT AND CO., Ltd., Thornycroft House, Smith-square, Westminster, S.W. 1.—Wall calendar with monthly tear-off sheets.

UNITED STEEL COMPANIES, Ltd., Sheffield.—Desk pad calendar.

WAILES DOVE BITUMASTIC, Ltd., Newcastle-on-Tyne.—Pocket diary.

WELIN-MACLACHLAN DAVITS, Ltd., 40, St. Vincent-place, Glasgow, C. 1.—Refills for desk calendar case.

WESTINGHOUSE ELECTRIC INTERNATIONAL COMPANY, 2, Norfolk-street, W.C. 2.—Pocket diary.

EDWARD WOOD AND CO., Ltd., Manchester.—Pocket diary.

Current Prices for Metals and Fuels.

IRON ORE.

N.W. COAST—	
(1) Native	17/9 to 22/6
(1) Spanish	17/– to 20/–
N.E. COAST—	
Native	18/– to 21/–
Foreign (c.i.f.)	16/–

PIG IRON.

	Home. £ s. d.	Export. £ s. d.
(2) SCOTLAND—		
Hematite	3 17 0	—
No. 1 Foundry	3 19 0	—
No. 3 Foundry	3 16 6	—
N.E. COAST—		
Hematite Mixed Nos.	3 11 0	3 11 0
No. 1	3 11 6	3 11 6
Cleveland—		
No. 1	3 6 0	3 6 0
Siliceous Iron	3 6 0	3 6 0
No. 3 G.M.B.	3 3 6	3 3 6
No. 4 Foundry	3 2 6	3 2 6
No. 4 Forge	3 2 0	3 2 0
Mottled	3 1 6	3 1 6
White	3 1 6	3 1 6
MIDLANDS—		
(c) Staffs.—	(*Delivered to Station.*)	
All-mine (Cold Blast)	—	—
North Staffs. Forge	3 6 0	—
„ „ Foundry	3 11 0	—
(c) Northampton—		
Foundry No. 3	3 7 6	—
Forge	3 2 6	—
Derbyshire—		
No. 3 Foundry	3 11 0	—
Forge	3 6 0	—
(3) Lincolnshire—		
No. 3 Foundry	—	—
No. 4 Forge	—	—
Basic	—	—
(4) N.W. COAST—		
N. Lancs. and Cum.—		
Hematite Mixed Nos.	4 3 6 (*a*) / 4 5 6 (*b*) / 4 10 6 (*c*)	—

MANUFACTURED IRON.

	Home. £ s. d.	Export. £ s. d.
SCOTLAND—		
Crown Bars	10 5 0	9 15 0
Best	—	—
N.E. COAST—		
Iron Rivets	11 10 0	—
Common Bars	10 15 0	—
Best Bars	11 5 0	—
Double Best Bars	11 15 0	—
Treble Best Bars	12 5 0	—
LANCS.—		
Crown Bars	10 5 0	—
Second Quality Bars	8 15 0	—
Hoops	13 0 0	—
S. YORKS.—		
Crown Bars	10 5 0	—
Best Bars	11 0 0	—
Hoops	12 0 0	—
MIDLANDS—		
Crown Bars	10 0 0 to 10 7 6	—
Marked Bars (Staffs.)	12 10 0	—
Nut and Bolt Bars	9 0 0 to 9 5 0	—
Gas Tube Strip	10 17 6 to 11 0 0	—

STEEL: (*d*)

	(6) Home. £ s. d.	(7) Export. £ s. d.
(5) SCOTLAND—		
Boiler Plates (Marine)	10 10 0	10 10 0
„ „ (Land)	10 0 0	10 0 0
Ship Plates, ½in. and up	8 15 0	7 15 0
Sections	8 7 6	7 7 6
Steel Sheets, ¼in.	8 15 0	8 15 0
Sheets (Gal. Cor. 24 B.G.)	11 7 6	11 5 0

STEEL (*continued*).

	Home. £ s. d.	Export. £ s. d.
N.E. COAST—		
Ship Plates	8 15 0	7 15 0
Angles	8 7 6	7 7 6
Boiler Plates (Marine)	10 10 0	—
„ „ (Land)	10 0 0	—
Joists	8 10 0	7 7 6
Heavy Rails	8 10 0	—
Fish-plates	12 0 0	—
Channels	10 5 0	£9 to £9 5s.
Hard Billets	8 2 6	—
Soft Billets	6 17 6	—
N.W. COAST—		
BARROW—		
Heavy Rails	8 10 0	—
Light Rails	8 15 0 to 9 0 0	—
Billets	6 15 0 to 9 10 0	—
MANCHESTER—		
Bars (Round)	9 7 6	—
„ (Small Round)	7 5 0	—
Hoops (Baling)	10 0 0	9 15 0
„ (Soft Steel)	9 0 0	8 15 0
Plates	8 17 6 to 9 2 6	—
„ (Lancs. Boiler)	9 7 6	—
SHEFFIELD—		
Siemens Acid Billets	9 10 0 (basis)	—
Hard Basic	9 2 6 and 9 12 6	—
Intermediate Basic	7 12 6 and 8 2 6	—
Soft Basic	6 5 0	—
Hoops	10 5 0	—
Soft Wire Rods	7 10 0	—
MIDLANDS—		
Small Rolled Bars	7 7 6 to 8 5 0	—
Billets and Sheet Bars	5 12 6 to 6 10 0	—
Galv. Sheets, f.o.b. L'pool	11 5 0	—
(2) Staffordshire Hoops	9 10 0	—
Angles	8 7 6	—
Joists	8 10 0	—
Tees	9 7 6	—
Bridge and Tank Plates	8 17 6	—
Boiler Plates	9 7 6 to 9 10 0	—

NON-FERROUS METALS.

SWANSEA—	
Tin-plates, I.C., 20 by 14 f.o.b.	15/3
Block Tin (cash)	118 0 0
„ (three months)	119 10 0
Copper (cash)	46 15 0
„ (three months)	46 10 0
Spanish Lead (cash)	15 2 6
„ „ (three months)	14 18 9
Spelter (cash)	13 15 0
„ (three months)	13 18 9
MANCHESTER—	
Copper, Best Selected Ingots	49 15 0
„ Electrolytic	50 0 0
„ Strong Sheets	77 0 0
„ Tubes (Basis Price), lb.	0 0 11½
BrassTubes (Basis Price), lb.	0 0 10
„ Condenser, lb.	0 1 0½
Lead English	16 7 6
„ Foreign	15 0 0
Spelter	14 0 0
Aluminium (per ton—raw ingot)	£95

FERRO ALLOYS.

Tungsten Metal Powder	2/6 per lb.	
Ferro Tungsten	2/3 per lb.	
	Per Ton.	Per Unit.
Ferro Chrome, 4 p.c. to 6 p.c. carbon	£23 5 6	7/–
„ „ 6 p.c. to 8 p.c.	£22 10 0	7/–
„ „ 8 p.c. to 10 p.c.	£22 0 0	7/–
„ „ Specially Refined		
„ „ Max. 2 p.c. carbon	£33 0 0	10/–
„ „ „ 1 p.c. carbon	£38 0 0	13/–
„ „ „ 0·70 p.c. carbon	£41 0 0	14/–
„ „ „ carbon free	11d. per lb.	
Metallic Chromium	2/7 per lb.	
Ferro Manganese (per ton)	£11 15 0 for home	
„ „ „	£11 5 0 for export	
„ Silicon, 45 p.c. to 50 p.c.	£11 10 0 scale 5/– per unit	
„ „ 75 p.c.	£18 0 0 scale 7/– per unit	
„ Vanadium	12/9 per lb.	
„ Molybdenum	4/2 per lb.	
„ Titanium (carbon free)	10d. per lb.	
Nickel (per ton)	£170 to £175	
Ferro Cobalt	9/6 per lb.	

FUELS.

SCOTLAND.

	Export.
LANARKSHIRE—	
(f.o.b. Glasgow)—Steam	13/6
„ „ Ell	15/–
„ „ Splint	15/6 to 16/6
„ „ Trebles	14/– to 14/6
„ „ Doubles	13/3 to 13/6
„ „ Singles	12/9 to 13/–
AYRSHIRE—	
(f.o.b. Ports)—Steam	13/–
„ „ Jewel	18/–
„ „ Trebles	14/–
FIFESHIRE—	
(f.o.b. Methil or Burntisland)—Steam	12/– to 13/6
Screened Navigation	16/6 to 17/6
Trebles	14/6 to 16/6
Doubles	13/–
Singles	12/6 to 13/–
LOTHIANS—	
(f.o.b. Leith)—Best Steam	12/6
Secondary Steam	12/–
Trebles	13/6 to 14/6
Doubles	12/6 to 12/9
Singles	12/6

ENGLAND.

(8) N.W. COAST—	
Steams	20/6 to 21/–
Household	32/6 to 53/6
Coke	21/– to 22/–
NORTHUMBERLAND	
Best Steams	13/6 to 13/9
Second Steams	12/6
Steam Smalls	10/– to 10/6
Unscreened	12/6 to 13/–
Household	25/– to 37/–
DURHAM—	
Best Gas	15/–
Second	13/– to 14/–
Household	25/– to 37/–
Foundry Coke	24/– to 26/–
SHEFFIELD—	Inland.
Best Hand-picked Branch	25/6 to 27/–
Derbyshire Best Bright House	20/– to 22/6
Best House Coal	20/6 to 21/6
Screened House Coal	18/– to 19/–
„ „ Nuts	15/6 to 16/6
Yorkshire Hards	14/– to 15/6
Derbyshire Hards	14/– to 15/6
Rough Slacks	7/6 to 8/6
Nutty Slacks	6/6 to 7/–
Smalls	2/6 to 5/–
Blast-furnace Coke (Inland)	11/– on rail at ovens
Furnace and Foundry Coke (Export), f.o.b.	15/6 to 16/–

(9) SOUTH WALES.

CARDIFF—	
Steam Coals:	
Best Smokeless Large	20/–
Second Smokeless Large	18/9 to 19/9
Best Dry Large	18/6 to 19/–
Ordinary Dry Large	17/6 to 18/–
Best Black Vein Large	18/3 to 18/6
Western Valley Large	18/– to 18/3
Best Eastern Valley Large	17/7½ to 17/9
Ordinary Eastern Valley Large	17/6 to 17/7½
Best Steam Smalls	13/6 to 13/9
Ordinary Smalls	11/6 to 12/9
Washed Nuts	17/6 to 22/6
No. 3 Rhondda Large	20/– to 20/6
„ „ Smalls	15/6 to 16/–
No. 2 „ Large	17/– to 17/3
„ „ Through	16/– to 16/6
„ „ Smalls	14/– to 14/3
Foundry Coke (Export)	27/6 to 35/–
Furnace Coke (Export)	17/6 to 20/–
Patent Fuel	21/6
Pitwood (ex ship)	26/6 to 26/9
SWANSEA—	
Anthracite Coals:	
Best Big Vein Large	35/– to 37/6
Seconds	27/– to 31/6
Red Vein	23/6 to 27/–
Machine-made Cobbles	41/6 to 45/–
Nuts	40/– to 46/–
Beans	24/6 to 28/–
Peas	20/3 to 21/6
Breaker Duff	9/9 to 10/3
Rubbly Culm	9/– to 9/6
Steam Coals:	
Large	19/6 to 21/6
Seconds	18/– to 19/6
Smalls	12/– to 13/–
Cargo Through	15/6 to 16/–

(1) Delivered. (2) Net Makers' Works. (3) f.o.b. Makers' Works, approximate. (4) Delivered Sheffield. (5) Glasgow, Lanarkshire, and Ayrshire. (6) Home Prices—All delivered Glasgow Station. (7) Export Prices—f.o.b. Glasgow. (8) Except where otherwise indicated, coals are per ton at pit for inland and f.o.b. for export, and coke is per ton on rail at ovens and f.o.b. for export. (9) Per ton f.o.b. (*a*) Delivered Glasgow. (*b*) Delivered Sheffield. (*c*) Delivered Birmingham. (*d*) Rebate: Joists (minimum), 12/6; Ordinary Ship, Bridge, and Tank Plates and Sections, 10/– if home consumers confine purchases from associated British Steel Makers. (*e*) Delivered Black Country Stations.

French Engineering Notes.

(From our own Correspondent in Paris.)

Nitriding Steel.

THE researches of Monsieur Léon Guillet, director of the Ecole Centrale, in the nitriding of steel have already given valuable results, and they have produced a further remarkable effect through an accidental discovery by one of his assistants, Monsieur Mahoux, when carrying out experiments at the laboratory of the Conservatoire des Arts et Métiers. This effect was described before the Académie des Sciences by Monsieur Guillet. Monsieur Mahoux found that the rate of nitriding steel was accelerated when high-frequency oscillations were passing through the furnace. If, under particular conditions, the depth of nitridation could not be more than $^{1}/_{100}$ mm., it was found that the electrical effect raised it rapidly to $^{35}/_{100}$ mm. The hardness and tensile strength of the steel were largely increased. Again, the electrical oscillations produced similar results on chromium and nickel, which were absorbed into the steel instead of merely adhering to it. Monsieur Guillet believes that there is a definite relation between the number of frequencies and the metals to be treated, and that it will be possible to effect nitriding at low temperatures. The Duc de Broglie remarked that there seemed to be some analogy between this discovery and that of a Polish experimenter, who had detected an influence of high-frequency oscillations on mercury vapour.

Compressed Gases.

Another interesting communication to the Académie des Sciences was made on behalf of Messrs. James Basset and R. Dupinay, who, with the aid of apparatus by which gases could be compressed up to 30,000 atmospheres, found that at very high pressures there was generally a greater deviation from the law of Mariotte than is generally supposed. Under a pressure of 5000 atmospheres, 1 litre of nitrogen is reduced to a volume of 1·305 c.cm. When increasing the pressure on gases from 1000 to 5000 atmospheres the increase in the energy necessary for that compression is only 24 per cent. A note was also presented on behalf of Monsieur G. F. Jaubert upon a colloidal diaphragm employed in apparatus for the electrolytic production of oxygen and hydrogen from which it appears that the gases thus produced have a very high degree of purity. As compared with the hydrogen usually employed for balloons the lifting power is increased by 30 to 35 grammes per cubic metre. This system of producing hydrogen is being used in the French Army for the inflation of balloons.

Polish Coal.

During the past few weeks some consignments of Polish coal have been unloaded at La Rochelle, and from a conversation I had with the captain of one of the German steamers, there is no doubt that preparations are being made to ship large supplies of this fuel to the Atlantic seaboard. I was assured that considerable quantities of Polish coal were going to the French ports. Before the war the coal mines in Silesia were worked almost entirely for the home market, but since they were incorporated into Polish territory they are being developed for export, and German shipping is profiting thereby. It is certain that, after pushing its way along Northern Europe and into Scandinavia the Polish coal trade is coming southwards and is beginning to compete in what has always been regarded as an exclusively British market. Steamers bringing coal from South Wales invariably return with freights. It remains to be seen whether the German ships can do the same thing. Meanwhile, the Polish Government is considering proposals for completing the construction of the railway which will put the Katowice coal basin into direct communication with the new port of Gdynia, near Dantzig. The total length of the line, which is intended mainly for coal transport, will be 315 miles. The Schneider group has offered to advance the money for the completion of the railway, and if the offer is accepted, the work will, of course, be entrusted to Messrs. Schneider & Cie.

"Le Génie Civil."

In celebrating its fiftieth anniversary by a banquet at the Palais d'Orsay, Paris, last week, *Le Génie Civil* marked a stage in a useful and successful career. The large gathering included many distinguished guests, and was presided over by Monsieur Watier, Conseiller d'Etat and Director of Inland Waterways at the Ministry of Transports. The difficulties in the way of starting a technical journal half a century ago were referred to by Monsieur Dumas, the editor of *Le Génie Civil*, who said that a modest beginning was made with very limited financial resources, supplied by a number of engineers who contributed to the funds without, apparently, any great faith in the future of an entirely new departure in journalism. Success came with the collaboration of those engineers, who gathered round as contributors and made the journal an indispensable factor in the progress of French engineering. Monsieur Léon Guillet, Director of the Ecole Centrale, spoke of the debt he owed to the paper and of the services rendered by Monsieur Dumas, which Monsieur Watier affirmed would be recognised by the Government. The banquet showed the high esteem in which *Le Génie Civil* is held by the engineering profession.

The Rhine-Rhone Canal.

The work of deepening and widening the canal between the Rhine and the Rhone, which is now practically completed, was a necessary part of the scheme to canalise the Rhone and create an uninterrupted waterway that would connect Marseilles with the inland waterway system of Central Europe. Since the Armistice, the French have been unable to undertake a work which the Germans had always refused to sanction, and now it will be possible to navigate 280-ton barges between the two rivers. On this canal, which links up the waterway system in France with the rivers and canals in Germany and Switzerland, it is proposed to create an inland port at Besançon.

British Patent Specifications.

When an invention is communicated from abroad the name and address of the communicator are printed in italics.

When an abridgment is not illustrated the Specification is without drawings.

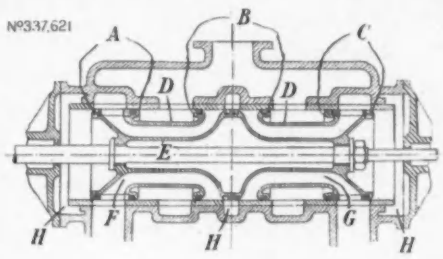
Copies of Specifications may be obtained at the Patent Office, Sale Branch, 25, Southampton-buildings, Chancery-lane, W.C., at 1s. each.

The date first given is the date of application; the second date, at the end of the abridgment, is the date of the acceptance of the complete Specification.

STEAM ENGINES.

337,621. November 18th, 1929.—PISTON VALVES, M. Willoteaux, 41, Boulevard de la Gare, Paris, France, assignee of Compagnie du Chemin de Fer de Paris à Orléans.

This invention relates to a double admission and double exhaust piston valve for the distribution of steam. The valve, according to the specification, comprises three circular followers A B C interconnected through cylindrical casings D E. These casings, which are braced by means of ribs, provide annular conduits F and G which open at the periphery of the followers. Packing rings provide the necessary fluid tightness and control the admission and exhaust phases through their arrangement with respect to the ports in the liner. The valve chest comprises three exhaust ducts H H H. Ducts F and G, which have

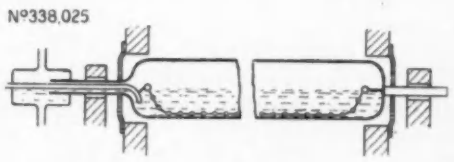


no connection with each other, serve successively for the additional admission and the additional exhaust. Obviously, a suitable arrangement would allow the valve to be adapted for operation with a mechanism providing the admission over the outside edges. In this case those spaces in the cylinder which were used for admission would serve for exhaust and conversely, so that the additional exhaust duct in the centre would become an additional admission duct. It is to be noted that the valve considered is somewhat similar to the so-called "double introduction" trick valve, but the latter departs from the one under consideration in that it comprises only one annular duct leading to both extremities, which provides for double admission but not for double exhaust.—*November 6th*, 1930.

STEAM GENERATORS.

338,025. December 6th, 1929.—CLEANING THE TUBES OF STEAM GENERATORS, Société Alsacienne de Constructions Méchanique, Mulhouse (Haut-Rhin), France; and Aktiebolaget Atmos, Stockholm, Sweden.

There is a significant note in this specification, in that the invention is applicable to boilers in which the tubes are rotated,

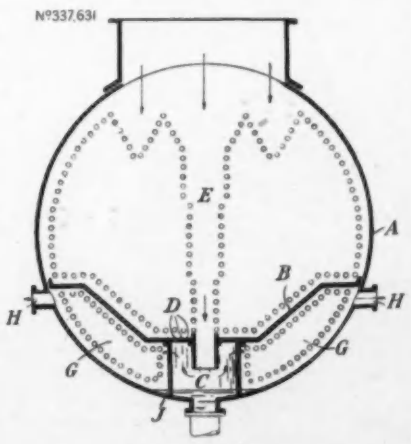


but that the speed of rotation is sufficiently low to allow the contained water to spread to a substantially horizontal layer. For the purpose of preventing the deposition of scale on the inside of the tube there is arranged within it a chain, as plainly shown in the illustration, that rubs around as the tube rotates.—*November 13th*, 1930.

CONDENSERS AND FEED-WATER HEATERS.

337,631. November 26th, 1929.—SURFACE CONDENSERS, *International General Electric Company, Incorporated, 120, Broadway, New York, United States of America.*

In the lower part of the condenser A a chamber C is provided beneath the collecting plate B for the condensed liquid, into

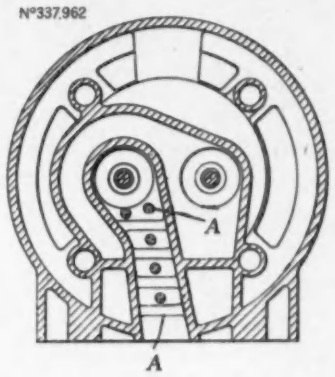


this chamber the water percolates through openings D and into it, too, exhaust steam for the preheating of the condensed liquid is conducted along a free path E between the condenser tubes. The condensed liquid collects in the lower part of the chamber, whilst the upper part serves as air suction space and collecting space for the vapours not condensed—non-condensing vapours. Through openings in the upper part of the chamber C the air separated out and the non-condensed steam is drawn by suction into the spaces provided beneath the collecting plate, which are in communication with the air suction device through openings H; these spaces G are penetrated at the lower part by the coldest condensing water tubes. The condensed liquid collecting in the spaces G flows through openings J back into the collecting chamber C.—*November 6th*, 1930.

INTERNAL COMBUSTION ENGINES.

337,962. October 31st, 1929.—VAPOURISERS FOR OIL ENGINES, G. M. Blackstone, F. Carter and E. Carter, Rutland Engineering Works, Stamford.

The inventors say that they have found that the vaporisation of the combustible charge of an oil engine is not usually complete

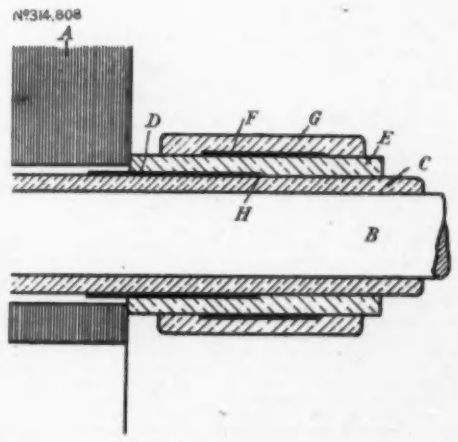


in that the inner portions of the column of air and fuel are not sufficiently heated by contact with the walls of the passage. As a consequence the vapour readily condenses on any cool surfaces. So they cast into the passage a number of transverse bars, as shown at A A, in order to conduct the heat of the walls to the interior.—*November 18th*, 1930.

DYNAMOS AND MOTORS.

314,808. July 1st, 1929.—PROTECTING THE INSULATING SLEEVES OF ELECTRICAL MACHINE WINDINGS FROM GLOW DISCHARGE PHENOMENA, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

It is known that it is possible to protect the insulating sleeves of H.T. electrical machine windings from the appearance of glow discharges by providing conducting or semi-conducting facings or liners on the outer side of the sleeve and, if desired, by also insulating them from the air. The conducting facings or liners may be applied only in the form of very thin sheets or foils. The intensity of the electric field is very great at the edges of the liners, and there is the risk that even when the edges are surrounded by insulating material of great strength changes will still be liable to occur at these places in the course of time. The object of the invention is to reduce the intensity of the field

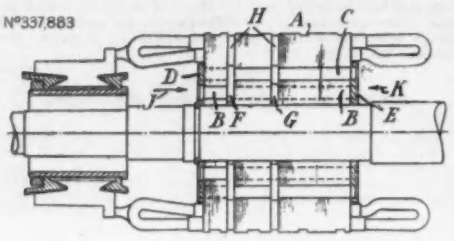


at the places in question. In the drawing A denotes the stator iron of a high-tension machine in which is situated the copper conductor B. C indicates the usual insulating sleeve which surrounds the copper conductor. On the sleeve there is a conducting foil D which is electrically connected to the stator iron A. On the foil there is an insulating layer E. On the layer E there is a second facing or liner F, which is constituted by a semi-conductor. The liner F is covered up by a further layer of insulating material. The action of the facing or liner F which extends at both sides of the edge H of the facing or liner D is as follows:—From the liner D some of the lines of force pass to the liner F and from the latter to the conductor B. If the liner F consists of resistance material then it contributes to the distribution of potential differences because currents are generated in it. These currents will not, however, excessively heat the coating.—*November 3rd*, 1930.

337,883. September 4th, 1929.—DYNAMO-ELECTRIC MACHINES, Donald Bright Hoseason, of "Grimsworth," Groby-road, Bowdon, Chester, and Associated Electrical Industries, Ltd., of Bush House, Aldwych.

This invention relates to A.C. and D.C. dynamo-electric machines, and in particular to electric motors, generators, and similar apparatus cooled by the flow or circulation of air or a gas through tunnels or ducts in the iron core. The armature core A is provided with two circular rows of axial ducts B and C, which are arranged as near as practicable to the armature slots without giving rise to undue and excessive flux densities in the core. The end plates D and E are perforated to correspond with the ducts B and C. The armature laminations are divided into three packets of unequal length with radial spaces F and G between them, the width of these spaces being preferably about $\frac{1}{8}$in. For instance, the left-hand packet may be the smallest—say, $1\frac{1}{2}$in. long—the middle packet 2in. long and the right-hand packet 4in. long. Radial spacers H are conveniently welded in position. The main air paths are indicated by the arrows J and K. The air velocity is preferably high and the air J flows into the axial

ducts B and C to the left-hand radial space F, whilst the air K flows into the ducts B and C to both the radial spaces G and F. The air J and K flows out of the armature radially. The ducts B and C on either side of the left-hand radial space F are relatively-

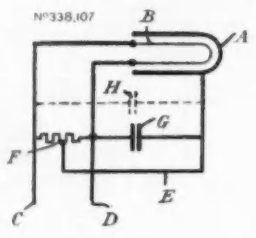


staggered, whilst the ducts B and C on either side of the right hand radial space G are not staggered. By this arrangement of ducts and radial spaces a "hot spot" which would otherwise exist near the left-hand end of the core is substantially removed.—*November 13th*, 1930.

TELEGRAPHS AND TELEPHONES.

338,107. October 21st, 1929.—RECEPTION OF WIRELESS SIGNALS, N. V. Philips' Gloeilampenfabrieken, of Emmasingel 13D Eindhoven, Province of North Brabant, the Netherlands.

This invention has reference to wireless receiving sets comprising two or more discharge tubes, the filaments of which are supplied from a common source of current. When using a receiver comprising one or more high-frequency amplifiers, a detector and one or more low-frequency amplifiers, and particularly when receiving short waves, the high-frequency stages react on each other and on the detector. This is due to the fact that when one of the two filament leads is connected to the anode current source the other has a given alternating potential relatively to the first-mentioned lead owing to the impedance of the filaments. It is by this lead that oscillations of a high-frequency

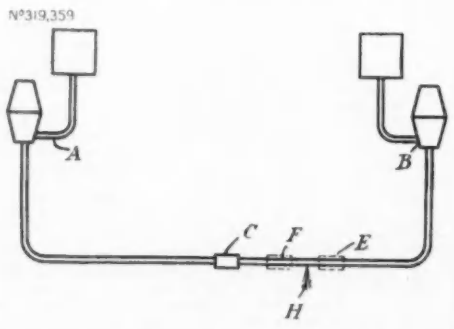


amplifier are passed on to following high-frequency stages and the detector. The invention has for its object to avoid this undesired coupling by the use of simple means. The drawing shows a diagram of a discharge tube having an indirectly heated cathode A. The filament B enclosed within the cathode is fed through the leads C and D. In addition, the cathode A is connected by means of a lead E to the centre of a potentiometer F connected in parallel to the filament B. It has been found that when more than one high-frequency stage is used the alternating potential existing between the lead E and the filament leads may give rise to undue couplings between the valves. In accordance with the invention a by-pass condenser G is interconnected between the lead E and the filament lead D. Although not essential, the lead E and the filament lead C may likewise have connected between them a condenser H so as to ensure absolute symmetry.—*November 13th*, 1930.

TRANSMISSION OF POWER.

319,359. September 12th, 1929.—LOCALISING LEAKS IN OIL-FILLED CABLES, Siemens-Schuckertwerke Aktiengesellschaft, of Berlin-Siemensstadt, Germany.

When making joints in an electric cable system employing cables of the type having hollow conductors serving as oil conduits connected to pressure tanks for the purpose of maintaining constant oil pressure in the surrounding impregnated insulation, it is customary to freeze the oil in the vicinity of the cable ends to be connected before the making of the joints. According to this invention, this process is also utilised for localising leaks in oil-filled cables, the leak being traced by sectional freezing of the oil. If the oil-filled cable has been damaged in the portion situated between the sleeves A and B the damage is manifest by the fall of the oil level or the oil pressure in the containers on the sleeves A and B. If, now, at a place C, preferably selected in the middle of the cable length A B, the oil in the cable is

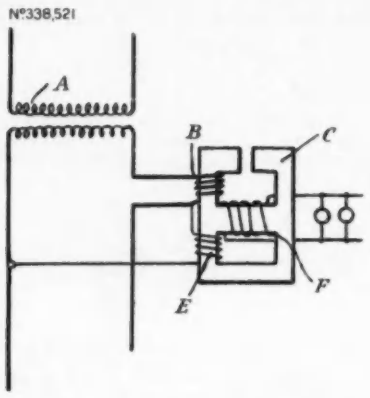


frozen, the damaged half may be recognised by the oil level in the container connected thereto falling further, while the oil level in the other container remains constant. On the assumption that the leak is thus found to be situated in the portion C B, another freezing place is disposed, preferably half-way between C and B, at the place E, while C may be allowed to thaw. If the level or pressure in the container A now falls, while remaining constant in B, the leak lies to the left of E and a fresh freezing place is disposed between C and E at the place F, while E may be allowed to thaw. Renewed fall in the oil level at B indicates that the leak is situated between E and F. According to this procedure, successive freezing places are chosen until the position of the leak is limited to a length of cable which is so short that it appears more economical to expose that short length rather than to dispose further freezing places. The discharge of oil from the exposed cable indicates the position H of the leak, which is then repaired.—*November 13th*, 1930.

MEASURING AND TESTING INSTRUMENTS.

338,521. August 19th, 1929.—MEASURING AND LIKE APPARATUS FOR USE WITH ELECTRIC CIRCUITS, The British Thomson-Houston Company, Ltd., Crown House, Aldwych, London, W.C. 2; John Gale Wellings, of "Ricky," London-road, Dunchurch, Rugby, and Charles Gilbert Mayo, of 17, Alexandra-road, Rugby.

For measuring conditions of voltage in high potential circuits, it has been realised that on account of the expense of potential transformers connected directly to the high potential circuit, it is advantageous to connect the potential transformer or measuring instruments to a low potential winding of a power transformer associated with the high potential circuit. The voltage so obtained from the low potential side of the power transformer does not, however, bear a strict proportionality to the potential existing at the high potential side of the power transformer. Where accuracy is essential, it is necessary to make some compensation for the impedance drop in the power transformer. In order to compensate for the reactance of the main transformer A, an auxiliary winding B is provided on the measuring transformer, the winding B being energised in accordance with the power current flowing through the transformer A. The additional magnetic circuit C is, preferably, provided



with an air-gap. The fluxes due to the windings E and B traverse a common path through the secondary winding F of the measuring transformer, and the voltage induced in the latter will be due to the vectorial sum of the two fluxes. That flux, produced by the series winding, may be controlled both in magnitude and in phase relationship with regard to the current in the series winding by adjustment of the ampère turns of the series winding, and the reluctance of the limb carrying the series winding, and according to requirements may be so determined that the voltage produced by such flux in the secondary winding will be proportional to and of the same phase relationship as the voltage drop in the power transformer for any condition of load or power factor. That flux produced by the shunt winding follows the usual laws of transformer action and induces a secondary voltage proportional to the voltage of the low-tension winding of the power transformer. This voltage, as already mentioned, is different from the high-tension voltage by an amount due to the drop in the power transformer, which difference is compensated for by the voltage induced by the series winding. Hence, the total secondary voltage produced in this manner is proportional to the high voltage, whatever drop may occur in the power transformer.—*November 19th*, 1930.

Forthcoming Engagements.

Secretaries of Institutions, Societies, &c., desirous of having notices of meetings inserted in this column, are requested to note that, in order to make sure of its insertion, the necessary information should reach this office on, or before, the morning of the Wednesday of the week preceding the meetings. In all cases the TIME *and* PLACE *at which the meeting is to be held should be clearly stated.*

TO-DAY.

INSTITUTION OF MECHANICAL ENGINEERS.—Storey's-gate, St. James's Park, London, S.W. 1. Extra general meeting. "An Experimental Investigation into Induction Conditions, Distribution, and Turbulence in Petrol Engines," by Mr. S. J. Davies. 6 p.m.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. "Weighing Machinery," by Mr. W. A. Benton. Illustrated by slides and exhibits. 7.30 p.m.

SATURDAY, JANUARY 3RD.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Christmas lectures: "The Electric Spark: No. III., Air as a Conductor of Electricity," by Professor A. M. Tyndall. 3 p.m.

MONDAY, JANUARY 5TH.

BRADFORD ENGINEERING SOCIETY.—The Technical College, Bradford. "Gliding," by Mr. H. G. Mitchell; following which a cinematograph film, "Flying," will be shown. 7.30 p.m.

TUESDAY, JANUARY 6TH.

BRITISH ASSOCIATION OF REFRIGERATION.—In the Hall of the Institution of Mechanical Engineers, Storey's-gate, St. James's Park, London, S.W. 1. Discussion on "Modern Rapid Freezing Methods" will be introduced by Mr. J. Piqué. 5.30 p.m.

INSTITUTE OF METALS: BIRMINGHAM LOCAL SECTION.—In the Chamber of Commerce, New-street, Birmingham. "Blast-furnace Reactions," by Mr. R. A. Hacking. 7 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—At the Royal Society of Arts, John-street, Adelphi, W.C. 2. "Automobile Plant Depreciation and Replacement Problems," by Mr. F. G. Woollard. 7.45 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Christmas lectures: "The Electric Spark: No. IV., The Mechanism of a Spark and Other Forms of Discharge," by Professor A. M. Tyndall. 3 p.m.

WEDNESDAY, JANUARY 7TH.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Informal meeting. Discussion, "Reinforced Concrete Deep-water Jetties," by Mr. Ernest Latham. 6 p.m.

THURSDAY, JANUARY 8TH.

INSTITUTE OF MARINE ENGINEERS.—In the Library of the Institute, The Minories, London, E.C. 3. Junior Section. "The Running and Maintenance of Steam Auxiliaries," by Mr. S. N. Kent. 7 p.m.

INSTITUTE OF METALS: LONDON LOCAL SECTION.—In th Rooms of the Society of Motor Manufacturers and Traders, Ltd., 83, Pall Mall, S.W. 1. "Extrusion," by Mr. R. Genders. 7.30 p.m.

INSTITUTION OF AUTOMOBILE ENGINEERS.—The Merchant Venturers' Technical College, Unity-street, Bristol. "Light Alloy Piston Development," by Mr. E. V. Pannell. 7 p.m.

INSTITUTION OF CIVIL ENGINEERS: BIRMINGHAM AND DISTRICT ASSOCIATION.—In the Chamber of Commerce, Birmingham. "Road Construction," by Mr. R. H. Wood. 6 p.m.

INSTITUTION OF ELECTRICAL ENGINEERS.—In the Lecture Theatre of the Institution, Savoy-place, Victoria Embankment, W.C. 2. "The Distribution of Energy Liberated in an Oil Circuit Breaker; with a Contribution to the Study of the Arc Temperature" (Electrical Research Association Report), by Mr. C. E. R. Bruce. An oil painting of Graham Bell will be presented to the Institution by Sir Hugo Hirst, Bart. The portrait is by Mr. W. W. Russell, R.A. 6 p.m.

INSTITUTION OF MUNICIPAL AND COUNTY ENGINEERS.—Meeting of the Northern Irish District at Town Hall, Main-street, Bangor, 2 p.m. A paper and discussion on "Urban Works," by Mr. G. H. Fleming. 3 p.m.

NORTH-EAST COAST INSTITUTION OF ENGINEERS AND SHIPBUILDERS.—In the Cleveland Scientific and Technical Institution, Middlesbrough. Tees-side Branch, Graduate Section. "Ironwork Practice," by Mr. J. R. Cone. 7.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Christmas lectures: "The Electric Spark: No. V., Some Properties of Sparks and Arcs," by Professor A. M. Tyndall. 3 p.m.

FRIDAY, JANUARY 9TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. "Monel Metal: Some Notes on its Production and Industrial Application," by Mr. J. Doonan. 7.30 p.m.

RAILWAY CLUB.—The Royal Scottish Corporation, Fetter-lane, London, E.C. 4. "Railway Reform," by Lord Monkswell. 7.30 p.m.

SATURDAY, JANUARY 10TH.

INSTITUTE OF BRITISH FOUNDRYMEN: LANCASHIRE BRANCH.—At the Grand Hotel, Manchester. Annual dinner. 6.30 p.m.

ROYAL INSTITUTION OF GREAT BRITAIN.—21, Albemarle-street, London, W. 1. Christmas lectures: "The Electric Spark: No. VI., Large Sparks," by Professor A. M. Tyndall. 3 p.m.

MONDAY, JANUARY 12TH.

ILLUMINATING ENGINEERING SOCIETY.—By invitation of the British Commercial Gas Association, in the Board Room at 28, Grosvenor-gardens, Victoria, S.W. 1. "Recent Developments in Gas Lighting," by Mr. E. L. Oughton. 7 p.m.

INSTITUTE OF METALS: SCOTTISH LOCAL SECTION.—In the Rooms of the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank-crescent, Glasgow. "Chromium Plating." by Mr. J. G. Roberts. 7.30 p.m.

TUESDAY, JANUARY 13TH.

INSTITUTE OF MARINE ENGINEERS.—The Minories, London, E.C. 3. "The Electrical Equipment of a Modern Ship," by Mr. J. E. Allan. 6 p.m.

INSTITUTE OF METALS: NORTH-EAST COAST LOCAL SECTION.—In the Electrical Engineering Lecture Theatre, Armstrong College, Newcastle-on-Tyne. "The Applications of High-nickel, Nickel-copper Alloys and Pure Nickel in Industry," illustrated by a cinematograph film, by Mr. N. C. Marples. 7.30 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, Westminster, S.W. 1. Discussion, "Experiments on Syphon Spillways," by Professor Arnold Hartley Gibson, Mr. Thomas Hulme Aspey, and Mr. Fred Tattersall. 6 p.m.

WEDNESDAY, JANUARY 14TH.

INSTITUTION OF CHEMICAL ENGINEERS.—At Burlington House, Piccadilly, London, W. 1. "The Concentration of Phosphoric Acid Solutions by Means of a Submerged Flame," by Mr. C. Featherstone Hammond. 8 p.m.

INSTITUTION OF CIVIL ENGINEERS.—Great George-street, S.W. 1. Students' meeting. "The Aerial Cableways at Nag Hammadi Barrage, Upper Egypt," by Mr. I. W. G. Freeman. 6 p.m.

FRIDAY, JANUARY 16TH.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. Lecture, "Some Problems Surrounding the Reorganisation of an Engineering Works," by Mr. K. W. Willans. 7.30 p.m.

NATIONAL CONFERENCE ON INDUSTRIAL MECHANISATION.—Hotel Metropole, London, W.C. 2.

WEDNESDAY, JANUARY 21ST.

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE.—Houghton-street, Aldwych, W.C. 2. "Muscular Work and Fatigue," by Dr. G. P. Crowden. 6 p.m.

FRIDAY, JANUARY 23RD.

JUNIOR INSTITUTION OF ENGINEERS.—39, Victoria-street, S.W. 1. Informal meeting. Lecture, "The Progress and Development of Steam Generators," by Mr. E. W. Thompson. (Illustrated by slides and a film). 7.30 p.m.

MONDAY, JANUARY 26TH.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. Cantor Lecture: "Some Modern Developments in Microscopy," by Dr. L. C. Martin. 8 p.m.

WEDNESDAY, JANUARY 28TH.

ASSOCIATION OF EX-SIEMENS' MEN.—At Gatti's Restaurant, King William-street, Strand, W.C. 2. Smoking concert.

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE.—Houghton-street, Aldwych, W.C. 2. "Muscular Work and Fatigue," by Dr. G. P. Crowden. 6 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London W.C. 2. "The Restoration of St. George's Chapel, Windsor Castle," by The Very Rev. Albert Baillie, Dean of Windsor. 8.30 p.m.

WEDNESDAY, FEBRUARY 4TH.

LONDON SCHOOL OF ECONOMICS AND POLITICAL SCIENCE.—Houghton-street, Aldwych, W.C. 2. "Muscular Work and Fatigue," by Dr. G. P. Crowden. 6 p.m.

ROYAL SOCIETY OF ARTS.—John-street, Adelphi, London, W.C. 2. "The Effect of Standardisation on Engineering Progress," by Mr. C. le Maistre. 8 p.m.